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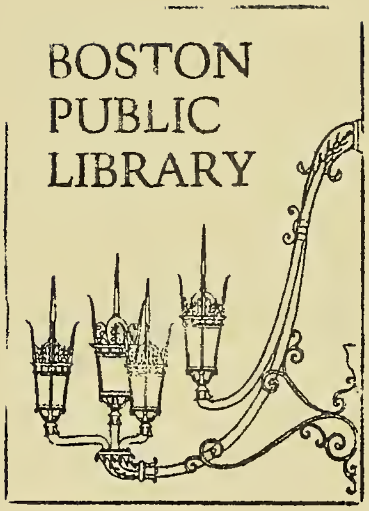

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Report

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NEW BOSTON GARDEN DEVELOPMENT

Submitted to
Executive Office of
Environmental Affairs
Commonwealth of
Massachusetts
MEPA Unit

Boston Redevelopment
Authority
City of Boston

Submitted by
New Boston
Garden Corporation

Prepared by
Vanasse Hangen Brustlin, Inc.

NEW BOSTON GARDEN CORPORATION

BOSTON GARDEN
A DELAWARE NORTH COMPANY
Anniversary 60th Celebration

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October 1, 1990

Mr. Stephen F. Coyle, Director
Boston Redevelopment Authority
One City Hall Plaza, 9th Floor
Boston, MA. 02201

Re: New Boston Garden Development
Boston, MA.

Proponent: New Boston Garden Corporation
151 Merrimac Street
Boston, MA 02114

attn: James R. Lowell, III

Dear Mr. Coyle:

On behalf of the New Boston Garden Corporation, please find enclosed ten (10) copies of the Draft Environmental Impact Report/Project Impact Report (Draft EIR/PIR) for the above referenced project which is being filed in accordance with Article 31 of the Boston Zoning Code. This Draft EIR/PIR is also being filed today with the Massachusetts Executive Office of Environmental Affairs MEPA Unit in accordance with 301 CMR 11.00. All parties named in the circulation list in Chapter VI of the Draft EIR/PIR will receive copies of this material.

If you have any questions concerning the New Boston Garden Development or this Draft EIR/PIR, please contact me or Robert M. Kaye at Vanasse Hangen Brustlin.

Sincerely,
New Boston Garden Corporation

James R. Lowell, III
Vice President for Development

Enclosure
cc: John Connolly, Mayor's Office
Richard Dimino, Boston Transportation Department

Environmental Impact Report — Project Impact Report

Draft **EIR** **PIR**

EOEA #7701

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NEW BOSTON GARDEN DEVELOPMENT

October 1990

Submitted to
Executive Office of
Environmental Affairs
Commonwealth of
Massachusetts
MEPA Unit

Boston Redevelopment
Authority
City of Boston

Submitted by
New Boston
Garden Corporation

Prepared by
Vanasse Hangen Brustlin, Inc.
Meredith & Grew, Inc.
Goodwin, Procter & Hoar
Thomson, French & Associates, Inc.
Ellerbe Becket, Inc.
Tech Environmental, Inc.
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Flack + Kurtz Consulting Engineers
Le Messurier Consultants
Peter Vanderwarker Photographs

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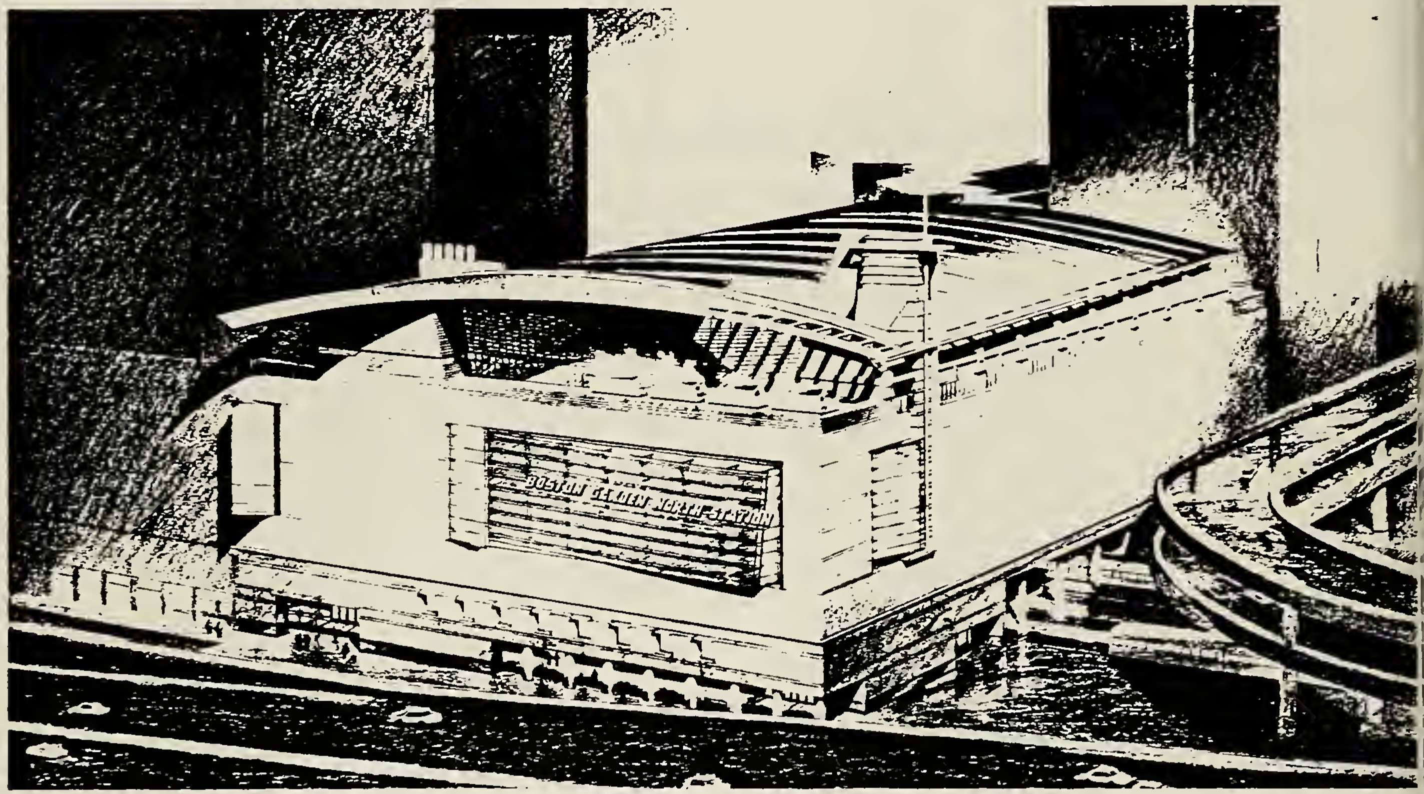
I Summary

NEW BOSTON GARDEN DEVELOPMENT (EOEA #7701)

New Boston Garden Corporation (NBGC) proposes to create a privately financed, multi-purpose arena and commercial development in Boston's North Station Urban Renewal District. This project, the New Boston Garden Development, will create a northern gateway to the City of Boston, provide important public spaces and benefits, assist in the revitalization of the North Station area, and continue to support existing local businesses. The major elements of this development include: 1) the New Boston Garden arena built in air rights over the Massachusetts Bay Transportation Authority's (MBTA) new North Station, commuter rail tracks, and a public parking garage; 2) a public concourse providing access from Causeway Street to serve the North Station commuter rail facilities and New Boston Garden; and 3) commercial development which includes office uses, an active retail base, and a six-level underground parking garage which includes the new rapid transit Green Line tunnel.

The existing Boston Garden has played an important role in the social, cultural, entertainment, sports, and political development of the city. However, due to the changing needs of sports and entertainment events, and to the age and deterioration of the building itself, the need for a state-of-the-art facility has become essential. The New Boston Garden will be a modern sports and entertainment arena built immediately behind (north of) the existing Boston Garden/North Station building. The New Boston Garden will be a replacement facility for the existing arena: it will be constructed in essentially the same location with some added seating capacity. The arena will be constructed in air rights over the MBTA's North Station commuter rail facilities and 1,300-space underground parking garage as part of a unique public and private partnership. Unobstructed views, full accommodations for the disabled, and improved lighting, sound, and mechanical systems are only some of the necessary enhancements that will be incorporated into the arena. The New Boston Garden will be a unique facility of regional importance.

The commercial component of the New Boston Garden Development will consist of three first-class office buildings. Two office buildings are proposed along Causeway Street, connected by a public concourse which will provide access to the MBTA ticketing facilities, the commuter rail cross-platform connecting the various tracks, the train shed housing the platforms, and a new station providing connections between the rapid transit Orange and Green Lines and facilitating connections with commuter rail. This Public Concourse will also serve as the main entrance to the New Boston Garden, with escalators providing access up to the arena entrance level. Active retail uses will be located on the lower levels of the two office buildings on each side of the Public Concourse.



Vanasse Hangen Brustlin, Inc.

Architect's Rendering of
the New Boston Garden
(View From Northeast Corner)

Figure I-1

Beneath the office buildings and Public Concourse on Causeway Street will be an underground garage with approximately 1,100 parking spaces. To the south of this garage beneath Causeway Street, a new below-grade Orange Line and Green Line transit station will be constructed by the MBTA. Direct access to a new "superplatform" will be provided through the lobby of the eastern office building on Causeway Street. A third office building will be constructed on Nashua Street to the west of the new arena. The proposed project is anticipated to be fully developed by 2000.

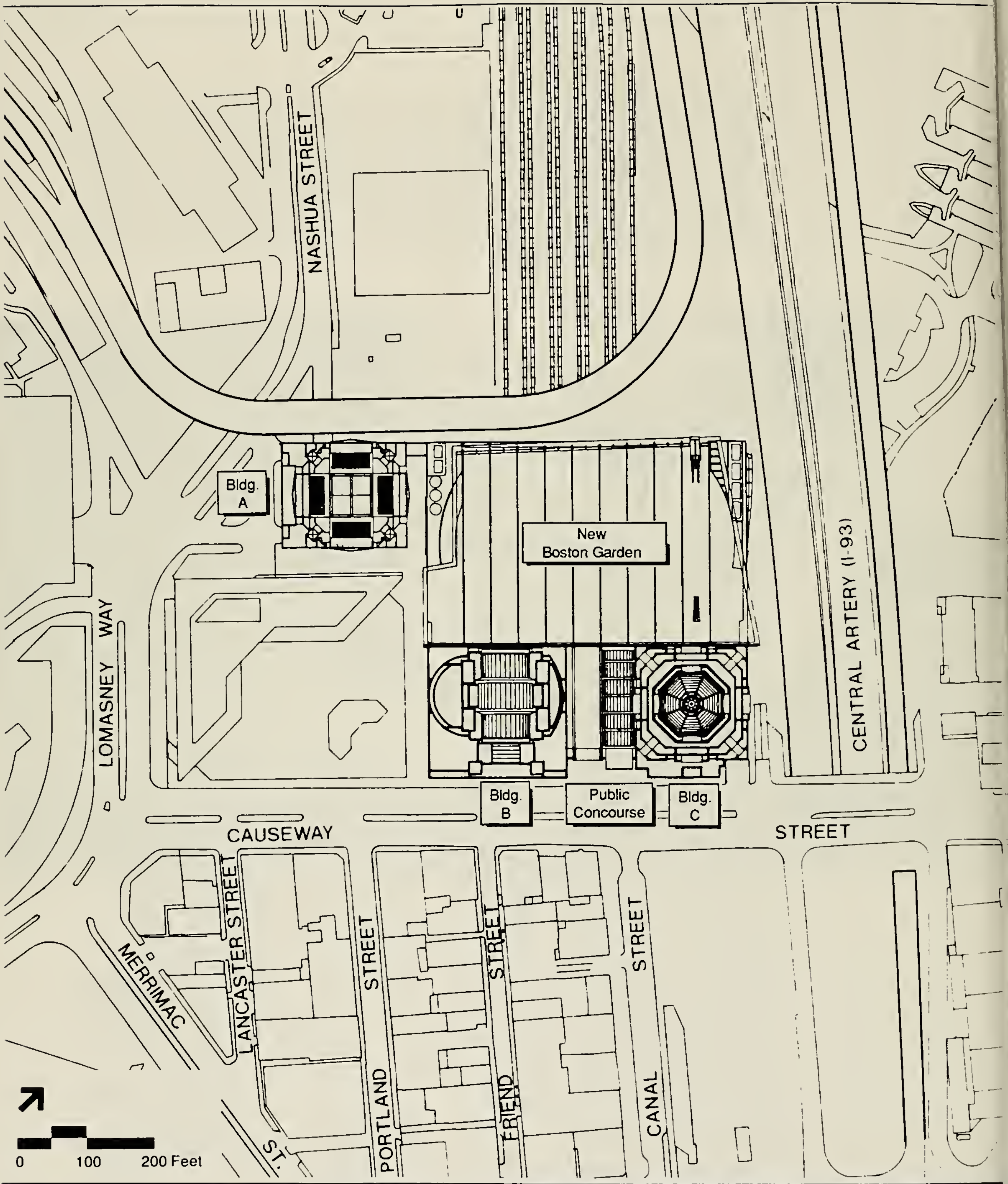
Building Program

The planning of the New Boston Garden Development has involved the close cooperation and support of several city and state agencies. Development planning has been conducted on the basis of two Memoranda of Agreement among the City of Boston, the Boston Redevelopment Authority (BRA), the MBTA, and New Boston Garden Corporation. Overall, the project has benefited from an extensive three-year coordination process that has involved numerous federal, state, and local agencies, officials, and organizations.

Over the past several decades, the Boston Redevelopment Authority has played an active role in creating, refining, and evaluating development alternatives for the North Station area. The New Boston Garden Development comprises a key element of these plans, and the project has been designed to respond to Article 39 of the Boston Zoning Code, the North Station Economic Development Area, effective September 13, 1989, and the Urban Renewal Plans for this area. The current building program is summarized below in Table I-1 and is illustrated in Figures I-1 and I-2.

Project Context

The New Boston Garden Development, located at North Station, is in an area of Boston which will undergo significant change over the next ten years due to planned public works projects. These projects include the depression of the Central Artery and the Central Artery North Area (CANA) project by the Massachusetts Department of Public Works (MDPW) and several MBTA projects, such as improvement of the North Station commuter rail facilities, depression and realignment of the rapid transit Green Line, and construction of an underground parking garage just north of the existing Boston Garden/North Station. The Green Line will be realigned between Haymarket and Science Park stations to run through a tube within two levels of the MBTA garage and the project Garage (below the office buildings and Public Concourse on Causeway Street) and will be connected to the Orange Line by the construction of a superplatform within a new underground station serving both lines. In addition, the City plans to upgrade Merrimac Street (southwest corner of the site) to be a major arterial roadway through this part of the city. These planned transportation improvements will make the North Station area one of the most accessible locations in both the city and the region.



Vanasse Hangen Brustlin, Inc.

Site Plan

Figure 1-2

Table I-1 BUILDING PROGRAM SUMMARY*

Use	Zoning Height (Feet)**	Gross Square Footage Office	Retail	Other	Total
Arena	162.5	--	--	755,500***	755,500
Public Concourse	55.0	--	--	16,000	16,000
Building A+	277.0	450,000	--	--	450,000
Building B+	425.0	844,000	39,000	--	883,000
Building C+	475.0	956,000	11,000	--	967,000
TOTAL	--	2,250,000	50,000	771,500	3,071,500
Parking Garage++	--	--	--	--	517,000

* The building program has been modified in certain respects from that specified in the ENF and PNF. In particular, the hotel space has been eliminated and there have been shifts in the location of office and retail space, with resultant changes in building heights. However, the total amount of space in the commercial component remains virtually unchanged.

** Represents zoning height to top of the highest occupied floor.

*** 19,500 seats (maximum capacity).

+ Buildings are in concept design stage and final height and program numbers may vary.

++ 1,100 parking spaces. Gross square feet includes MBTA Green Line tunnel.

The project is located in the vicinity of several distinct districts and neighborhoods of the City of Boston. These include the Bulfinch Triangle Historic District, the North End, the West End/Charles River Park, Government Center and the medical facilities of the Spaulding Rehabilitation Hospital and the Massachusetts General Hospital complex. The design and planning of the New Boston Garden Development responds to this context. The mix of an arena, train facilities, and office use is similar to the existing relationship between Boston Garden, North Station, and the Anelex Building (150 Causeway Street). Historically, the site has been the location of large-scale buildings associated with rail activities, and reflects the scale of uses within the North Station area, the West End, and Government Center. In recognition of the adjacent historic district, the bases of the Public Concourse and the two office buildings on Causeway Street have been designed to be of compatible heights with structures in the Bulfinch Triangle and the North End.

The arcade pattern established by the adjacent General Services Administration (GSA) Building will be continued along Causeway Street, uniting the various project components and providing shelter for pedestrians. Improved pedestrian connections will be provided through the project site, from Causeway Street to Nashua Street, connecting with routes to the nearby uses such as Massachusetts General Hospital, Spaulding Rehabilitation Hospital, and the Registry of Motor Vehicles. In addition, the Central Artery project mitigation plans call for extensive pedestrian facilities along the Charles River to the northeast of the project site. Full public access will be provided throughout the entire ground floor of the project.

The proposed new arena and commercial development will help facilitate the redevelopment of the North Station district and the numerous public works projects being undertaken in this area, and will contribute to the revitalization of an important and historic area of the city.

PROPONENT/DEVELOPMENT ENTITIES

New Boston Garden Corporation
150 Causeway Street
Boston, Massachusetts 02114

New Boston Garden Corporation is the proponent for the new multi-purpose arena, the New Boston Garden. NBGC is a subsidiary of Delaware North Companies, Inc., owner of the existing Boston Garden/North Station. The Boston Bruins hockey team is a personal holding of one of the shareholders of Delaware North Companies, Inc. At the present time, NBGC is actively negotiating with developers who might participate in the commercial component of the project.

DOCUMENT STATUS

This document comprises the Draft Environmental Impact Report (EIR) for submission to the Executive Office of Environmental Affairs for environmental review purposes, as required by the Massachusetts Environmental Policy Act (MEPA). In addition, this document is being submitted to the Boston Redevelopment Authority as a Draft Project Impact Report (PIR) for development review purposes, as required by Article 31 of the Boston Zoning Code.

This Draft EIR/PIR addresses:

- The September 8, 1989 MEPA Certificate issued in response to the New Boston Garden Development Environmental Notification Form (ENF), noticed in the Environmental Monitor on April 27, 1989 which incorporates the BRA Scoping Determination

- The BRA Scoping Determination issued August 18, 1989 (as revised) in response to the Project Notification Form (PNF) submitted April 24, 1989

- Pertinent comments from public agencies and other interested parties received in response to the ENF and PNF

These documents are presented in Chapter VII, MEPA and BRA Correspondence.

ORGANIZATION OF THE DRAFT EIR/PIR

The Draft EIR/PIR is organized as follows: Chapter I discusses the project's evolution and summarizes the conditions of the existing site, the proposed development alternatives, and the results of the technical analyses. Chapter II describes the project and the development alternatives, while Chapter III describes the site and area context. Chapter IV presents detailed results of the environmental analyses. Chapter V summarizes the proposed mitigation measures for each environmental impact category. Chapter VI presents the list of reviewers for the EIR/PIR, and Chapter VII contains copies of MEPA and BRA documents relevant to this EIR/PIR.

The Project Data appendix contains materials which support the findings of analyses in the Draft EIR/PIR. This volume provides additional technical data on a number of environmental issues, including transportation, air quality, wind, infrastructure, water quality, and others.

Additional project information for the Boston Redevelopment Authority's review is provided in the Project Data appendix. This data includes evidence of site control, development pro formas, and information on zoning requirements and community participation. Summaries of this information are provided in the Draft EIR/PIR.

A record of the urban design submission for the Project Impact Report is included in the Urban Design Component appendix. These materials include photographs, plans, and a massing model for the BRA's review. They are available for public review in the BRA's offices.

Documentation of the architectural, engineering, historic, social, and cultural significance of the existing Boston Garden and North Station is provided in the Historic Resources appendix. Copies of this volume will be on file with the Massachusetts Historic Commission, the Massachusetts State Archives, the Boston Landmarks Commission, and the New England Sports Museum.

EVOLUTION OF THE PROJECT

The concept of a new or rehabilitated arena to serve Boston's needs has been a topic of discussion and planning for more than two decades. Various agencies and entities have prepared studies or otherwise evaluated a number of options relating to a sports and entertainment arena, including: construction of a new arena; renovation of the existing Boston Garden; multi-use developments including sports and entertainment facilities; and alternative sites for a new arena. Many of these evaluations are summarized in Chapter II, Project Description. In particular, a 1984 report entitled Massachusetts Convention Center Authority, Multi-Purpose Arena Feasibility Study, Summary of Findings, Phase I concluded that two sites--a Fort Point Channel site and the North Station site immediately behind (north of) the existing Boston Garden--were technically feasible for an arena, and the study recommended that the North Station site be carried forward for further analysis.

In 1985, the Boston Public Facilities Department issued a request for proposals for a multi-use development on the City-owned Nashua Street parking lot at North Station, including a new or substantially renovated arena, office and retail space, a hotel, housing, and parking. The request, entitled Design Development Guidelines: Nashua Street Parking Lot, North Station, City of Boston Public Facilities Department, specified design development guidelines and criteria for review of such development proposals. Three separate development proposals were submitted. Each of these proposals contained data on a proposed building program, design, financial feasibility, and environmental effects. None of the three proposals were acceptable to the City.

In 1987, New Boston Garden Corporation submitted to the City an alternative development proposal, including the construction of a new, state-of-the-art, multi-purpose arena near the existing Boston Garden site. In June of 1988, New Boston Garden Corporation received notice of the City's intent to grant NBGC tentative designation to redevelop Boston Garden/North Station. In January 1989, a Memorandum of Agreement (MOA) was reached between the City, the BRA, and NBGC establishing the terms and conditions of the development program. The development program analyzed in this Draft EIR/PIR is based on this agreement, as amended. The MOA permits NBGC to construct a new arena on city-owned air rights behind the existing Boston Garden and to develop a total of 2.3 million square feet of commercial space on the site of the existing arena and adjacent parcels. In February 1989, a Memorandum of Agreement was reached between NBGC and the Massachusetts Bay Transportation Authority, owners of the commuter rail facilities at North Station. Together these two agreements provide that NBGC, the City, the BRA, and the MBTA will cooperate in the design and construction of the New Boston Garden Development. In September 1990, a letter summarizing revised development planning assumptions was submitted by NBGC to the City and the BRA. This letter, along with the original MOAs, constitutes the basis for the current planning of the New Boston Garden Development.

DEVELOPMENT ALTERNATIVES AND ANALYSIS CONDITIONS

This Draft EIR/PIR considers the No-Build and the Build alternatives, as directed in the study scopes issued by the BRA and the MEPA Unit. These two alternatives are analyzed and compared under future 1995 and 2000 conditions. The development alternatives and analysis conditions are summarized in the following sections.

No-Build Alternative

The No-Build alternative consists of the continued operation of the existing Boston Garden and North Station. This alternative would require the provision to NBGC of a staging and storage facility with vehicular access to replace facilities and access currently provided by the Anelex Building, which is scheduled to be demolished as part of the MDPW's Central Artery reconstruction project. The No-Build alternative also includes area development projects and transportation improvements anticipated to be completed by 2000. These transportation projects include:

- Construction of a new MBTA underground parking garage (1,300 spaces) immediately north of the existing Boston Garden. This work will involve roadway improvements to Causeway and Nashua streets.

- Relocation of the existing elevated MBTA rapid transit Green Line to a new alignment beneath the existing Boston Garden/North Station, within a tube in the new MBTA underground garage. This work includes demolition of the existing elevated rapid transit Green Line along Causeway Street and Lomasney Way.

- Creation of a new underground rapid transit station serving both the Orange and Green rapid transit lines.

- A 275-foot extension of the MBTA North Station commuter rail platforms to the north facade of the existing Boston Garden. This work will also raise the platform heights to improve accessibility for the disabled.

- Redesign of Nashua Street to accommodate flows to and from the MBTA underground parking garage.

- Reconstruction of Merrimac Street to create a new arterial roadway providing access from downtown to the regional highway system.

- Depression of the existing elevated Central Artery, including reconstruction of City Square in Charlestown as part of the Central Artery North Area project. This project is being conducted by the MDPW.

Build Alternative (New Boston Garden Development)

The New Boston Garden Development will include a state-of-the-art sports and entertainment arena and a commercial element with office and retail uses. The project will replace the outdated and inadequate existing facilities and will contribute to the revitalization of the North Station urban renewal area.

As shown in Figure I-2, the New Boston Garden Development consists of four major elements including:

- A 19,500 seat (755,500 square feet) multi-purpose arena;

- A commercial component of three buildings containing 2,300,000 square feet of office and retail space;

- A public concourse containing a minimum of 16,000 square feet; and

- An underground parking garage for 1,100 vehicles.

The New Boston Garden Development will be built on the site of and adjacent to the existing Boston Garden/North Station. The New Boston Garden will be built above the MBTA below-grade parking garage and North Station commuter rail facilities to be located north of the existing Boston Garden/North Station. The arena floor will be 35 feet above grade, and the roof height will be approximately 165 feet above grade.

The New Boston Garden will be accessed primarily from Causeway Street through a new Public Concourse (built on the site of the existing arena) flanked by two office buildings fronting on Causeway Street. Escalators, elevators, and stairs will provide access for patrons up to the arena level, while train ticketing facilities, a passenger waiting room, and commuter rail platforms will be located at-grade. The Public Concourse will join the lobbies of the two office buildings (Buildings B and C), and active retail uses will be located on their lower levels.

A third office building (Building A) will front on Nashua Street and will be linked to the other project components by two pedestrian streets. Building heights of the office buildings will range from approximately 275 to 475 feet (21 to 37 floors) to the top of the highest occupied floor. The Public Concourse will be approximately 55 feet high. Below-grade parking will be provided for approximately 1,100 vehicles in a garage located on the site of the existing Boston Garden/North Station below the Public Concourse and Buildings B and C.

The Build Alternative will be complete by 2000. For the purposes of the Draft EIR/PIR, the Build Alternative is evaluated in the context of the background development that is occurring in the city at the midpoint of the construction phase and at project completion. The following section describes the timeframes used to evaluate the environmental impacts of the proposed development.

Analysis Conditions

In order to compare the effects of the No-Build and Build alternatives, five conditions were identified. These conditions include the following:

- 1990 Existing Conditions - represents the baseline analysis condition for comparison of future conditions
- 1995 No-Build Conditions - assumes continued use of the existing Boston Garden and North Station (with required replacement staging, storage, and access facilities) and also considers other area development anticipated to occur by 1995
- 1995 Interim-Build Conditions - analyzes the proposed project at a midpoint in its development, which includes only the arena, Building C, the Public Concourse, and Garage
- 2000 No-Build Conditions - assumes continued use of the existing Boston Garden and North Station (with required replacement staging, storage, and access facilities), and also evaluates the impacts of other area projects anticipated to be completed by 2000
- 2000 Full-Build Conditions - analyzes the effects of the total New Boston Garden Development (arena, Buildings A, B, and C, Public Concourse, and Garage)

PUBLIC BENEFITS

The proposed New Boston Garden Development will provide a new, privately financed, state-of-the-art, multi-purpose sports and entertainment arena for the City of Boston. The new arena will continue to be the home of two professional sports teams, the Bruins and the Celtics, and is expected to host approximately 240 events in its first year, including family entertainment, concerts, and sports events. The annual number of events is expected to increase in each successive year, up to a maximum of 270 annual events. The New Boston Garden will have a maximum seating capacity of 19,500, making it the largest indoor entertainment facility in New England. In addition, the project will include office and retail components which will contribute significantly to the economic expansion of Boston and to the strengthening of the city's tax base.

The New Boston Garden Development will generate a variety of important public benefits, including taxes to the city and state, job opportunities, transportation improvements, housing contributions, public amenities, infrastructure improvements, and cultural and social benefits. These benefits are summarized below and are described in greater detail in Chapter II, Project Description. Some of these benefits will be one-time contributions, and others will be annual. Not included are the multiplier effects to the Boston economy, which could total several times the value of direct contributions.

In addition to the items described below, the Boston Garden has a long history of charitable contributions to the community. These contributions have been in the form of donations of tickets and skyboxes, advertising services, and support and underwriting of events such as the Boston Shoot-Out to benefit the Boys and Girls Clubs of Boston.

Arena

Fiscal Benefits

- Increase in annual property taxes paid to the City - $2.5 million

Transportation Benefits

- Off-street storage provisions for broadcast media vehicles
- Off-street bus loading and parking areas
- Off-street arena service access, including a truck ramp from Nashua Street to the arena event-floor level
- Coordination with MBTA on project design to facilitate commuter rail, rapid transit, and arena patron circulation and public safety
- Improved pedestrian connections between the arena and public transportation facilities

Job Benefits

- 700 construction jobs
- Total construction earnings - $25 million
- 50 new permanent jobs
- An aggressive program for recruiting Boston residents, minorities, and women for construction jobs
- Approximately one-half of new permanent entry-level jobs targeted for Boston residents
- Jobs linkage funds - $425,000

Housing Benefits

- Housing Linkage funds - $2.1 million

Public Amenities

- Multi-purpose, state-of-the-art sports and entertainment arena
- Improved visual environment, public spaces, and pedestrian connections and street crossings

Infrastructure Improvements

- Improvements to the storm drainage system serving the site. This will result in reduced flows to combined sewers currently serving the site, and thus will lead to improved water quality in the Charles River and Boston Harbor.

Commercial Component

Fiscal Benefits

- Increase in annual property taxes paid to the City - $17 million

Transportation Benefits

- New commuter rail passenger waiting room and ticketing area
- Improved pedestrian access between MBTA Orange and Green rapid transit lines and commuter rail facilities
- Improved pedestrian access from MBTA facilities to Causeway and Nashua streets
- Improved pedestrian streetscapes surrounding the project
- Improved pedestrian crossings at key intersections
- Improved pedestrian access through the project site
- Improved vehicular access to MBTA commuter rail and rapid transit services
- Coordination with MBTA on project design to facilitate patron circulation and public safety
- Integration of the relocated MBTA Green Line into the subsurface project design from its existing elevated alignment

- New off-street parking for arena patrons with daytime shared-use by commercial component tenants
- Coordination of project Garage and MBTA garage designs to allow for single operator

Job Benefits

- 2,400 construction jobs
- Total construction earnings - $100 million
- 8,300 permanent jobs created on-site
- An aggressive program for recruiting Boston residents, minorities, and women for construction jobs
- Approximately one-half of new permanent entry-level jobs targeted for Boston residents
- Jobs linkage funds - $2.2 million

Housing Benefits

- Boston housing linkage funds - $11 million

Public Amenities

- Improved visual environment, public spaces, and pedestrian connections and crossings
- Daycare facilities totaling 12,000 square feet, including a minimum of 4,000 square feet on-site

Infrastructure Improvements

- Improvements to the storm drain system serving the site
- Removal of large quantities of stormwater inflow from the BWSC and MWRA sewerage systems
- Improvement to Nashua Street roadway network

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Other Developments in Boston

None.

Legal Claims

On May 29, 1990, Lincoln Property Company CSE, Inc. commenced an action against New Boston Garden Corporation relating to a joint venture agreement entered into on May 23, 1985 and amended on October 3, 1985 between Lincoln Property and New Boston Garden Corporation. The agreement concerned the planning of a project involving renovation and improvement of the existing Boston Garden, restoration and improvement of North Station, and construction of a new integrated, mixed-use commercial complex adjacent to Boston Garden/North Station.

In its complaint, Lincoln Property asserts that New Boston Garden Corporation violated certain provisions of the agreement (or obligations emanating from the agreement) when New Boston Garden Corporation submitted to the City of Boston in June 1987 a proposal that included a new sports and entertainment arena and the construction of a multi-use commercial development. New Boston Garden Corporation asserts that the agreement has been terminated.

A preliminary injunction enjoining New Boston Garden Corporation from proceeding with the current project was denied. Additionally, Lincoln Property is seeking specific performance of the agreement and certain damages, costs, and attorneys fees. These actions and counterclaims are still pending.

Tax Arrears

None.

Site Area and Easements

The New Boston Garden Development will be located on approximately 6.7 acres of land in Boston's North Station area. New Boston Garden Corporation owns a 2.0-acre parcel currently occupied by the existing Boston Garden/North Station. The additional fee interests, easements, and air rights comprising the site, and additional consents will need to be acquired from the City of Boston, the Boston Redevelopment Authority, the Massachusetts Bay Transportation Authority, the Massachusetts Hospital Corporation, and the Massachusetts Department of Public Works. These parcels and conveyances are described in greater detail in Chapter III, Site and Area Description, and in the Project Data appendix.

Site Control

The planning for the New Boston Garden Development is based on a Memorandum of Agreement among New Boston Garden Corporation, the City, and the Boston Redevelopment Authority dated January 26, 1989 and amended March 15, 1990, and a Memorandum of Agreement between New Boston Garden Corporation and the MBTA dated February 15, 1989 (collectively, the Development Agreements). The Development Agreements provide that New Boston Garden Corporation, the City, the BRA, and the MBTA will cooperate in the design and construction of the New Boston Garden Development and that New Boston Garden Corporation will be granted development rights and other appropriate temporary and/or permanent cross-rights and easements for use and access during and after construction.

As described above, New Boston Garden Corporation owns a portion of the project site. The specific conveyances by which New Boston Garden Corporation will gain control of the other portions of the site and the other rights necessary for the project are described in the Project Data appendix.

REGULATORY CONTROLS

Zoning

The New Boston Garden Development project site lies entirely within the North Station Economic Development Area (EDA) and is, therefore, subject to the zoning regulations set forth in Article 39 of the Boston Zoning Code. Pursuant to Section 39-8 of the Code, the project proponent will propose the establishment of a Planned Development Area (PDA) in the New Boston Garden Area, a PDA-eligible area designated under Article 39 of the Code. The PDA will be implemented through the proponent's submission of a Development Plan to the Boston Redevelopment Authority for Approval under Section 3-1A(a) and Section 39-8 of the Code. The proponent has designed the project to comply with the goals of the North Station EDA and the other applicable zoning restrictions of Article 39. Based on the proposed design of the project's commercial component, the proponent will seek zoning relief to increase the maximum allowed height allowed in the PDA. The proponent will also submit a Development Impact Project Plan for approval in accordance with Article 26A and 26B of the Code.

Permits/Approvals/Notices

At this point in the planning process, it is not possible to determine all of the permits, approvals, and notices which may eventually be required for the New Boston Garden Development. The following list represents agency reviews, permits, approvals, and notices which are or may be required for the proposed project. Permits and approvals are denoted by (A) for arena, only, (C) for the commercial component and Garage, only, or (B) for the arena, commercial component, and the Garage. Where actions may be sought for both the arena and commercial component, the responsibilities of the respective development entities will be independent, but coordinated, as appropriate.

Federal

- US Department of Transportation, Federal Aviation Administration, Notice Regarding Objects Affecting Navigable Airspace (B)

- US Environmental Protection Agency, National Pollutant Discharge Elimination System Permit (C); Notice Concerning Asbestos Removal (C)

State

- Massachusetts Department of Environmental Protection, Chapter 91 License for New Structures (A); Water Quality Certification (C); Surface Water Discharge Permit (C); Fuel Utilization Facility Approval (B); Sewer Connection/Extension Permit (B); Chapter 21E Notice and Review (C); Notice Concerning Asbestos Removal (C); Notice Concerning Commencement of Construction or Demolition (B).
- Massachusetts Historical Commission, Determination of Effect on Historic Properties (B).
- Massachusetts Executive Office of Environmental Affairs, MEPA Certification, including Section 61 Findings by state agencies issuing permits (B).
- Massachusetts Executive Office of Transportation and Construction, Consent to Issuance of Building Permits for Construction on Former Railroad Right-of-Way or Land Appurtenant Thereto (B).
- Massachusetts Department of Public Works, Access Permit (B).
- Massachusetts Water Resources Authority, Sewage Discharge Permit (A).

Local

- Boston Conservation Commission, Wetlands Order of Conditions (A).
- Boston Zoning Commission, Approval of Development Plan (B); zoning relief for building heights (C).
- Boston Redevelopment Authority, Development Plan and Development Impact Project Plan Approval (B); Article 31 Development Approval and Final Adequacy Determination (B); Design Approval (B); Cooperation Agreement (B).
- Boston Office of Jobs and Community Service, Boston Resident Construction Employment Plan (B).
- Boston Civic Design Commission, Design Approval (B).
- Boston Transportation Department, Transportation Access Plan Agreement, including a Construction Management Plan (B).
- Boston Public Improvements Commission, Street and Sidewalk Alteration Permits (B).
- Boston Water and Sewer Commission, Local Sewer Connection Permit (B).

- Boston Air Pollution Control Commission, Compliance with Construction Noise Regulations (B); Parking Freeze Permit (C).
- Boston Inspectional Services Department, Building Permit (B).
- Boston Fire Department, Approval of Fire Safety Equipment (B).
- Boston Public Safety Commission, Permit to Erect and Maintain Parking Garage (C); License for Storage of Flammables in Garage (C).

COMMUNITY CONSULTATION

In conjunction with the project planning and the preparation of this Draft EIR/PIR, New Boston Garden Corporation has conducted an active public consultation process. These activities have included ongoing communication with city, state, and federal officials; local residents, landowners, and business people; and other interested parties. Since 1987, over 300 such consultation meetings have occurred. The purpose of this section is to document the community consultation process which has occurred to date as part of the New Boston Garden Development. Among the groups met with in this process are:

Interested Parties

- Downtown North Association - the Board of Directors, membership at-large, and numerous sub-committees, including the Boston Garden Development Committee and the Central Artery Committee
- Arena Access Advisory Committee - convened by the project proponent in 1988, the group represents a cross-disability membership who advise the proponent and their architects on accessibility issues. The proponent is committed to making the arena a model of accessibility to disabled persons, and toward this goal, the following parties have generously given their time:
    - Mayor's Commission for Persons with Disabilities
    - Veterans Administration Medical Center
    - State Office of Handicapped Affairs
    - Massachusetts Commission for the Deaf and Hard of Hearing
    - Massachusetts Commission for the Blind
    - Massachusetts Coalition of Citizens with Disabilities
    - Boston Self Help Center
- Charles River Working Group - whose members have the following affiliations:
    - Charles River Watershed Association
    - American Society of Landscape Architects
    - Artery Business Committee
    - The Sierra Club
    - Cambridge Conservation Commission
    - Cambridge Community Development
    - Save the Harbor/Save the Bay
    - Hawthorne Condominium Trust

- North End/Waterfront Neighborhood Council
- Artery Business Committee

Abutters

- Charles River Park
- Massachusetts General Hospital
- Spaulding Rehabilitation Hospital
- General Services Administration

City Agencies

- Mayor's Office
- Boston City Council
- Boston Redevelopment Authority
- Boston Transportation Department
- Boston Water and Sewer Commission
- Boston Environmental Department
- Boston Public Works Department
- Boston Department of Inspectional Services
- Boston Public Facilities Department
- Boston Real Property Department
- Boston Landmarks Commission
- Boston Civic Design Commission

State Agencies

- Governor's Office of Economic Development
- Executive Office of Transportation and Construction
- Massachusetts Bay Transportation Authority - because of the close coordination required between the North Station Improvement Project and the New Boston Garden Development, the MBTA has been involved in all aspects of the arena design and development and has participated with the proponent in joint presentations of the project.

- Massachusetts Department of Public Works
- Central Artery/Third Harbor Tunnel Project Team
- Massachusetts Department of Environmental Protection
- Massachusetts Water Resources Authority
- Massachusetts Historical Commission
- Massachusetts Architectural Access Board

The project proponent is committed to a participatory process with neighbors, interested parties, and state and local agencies. New Boston Garden Corporation will continue to participate in meetings and make public presentations of the project throughout the environmental review process. These efforts will be focused on: 1) responding to questions pertaining to this Draft EIR/PIR; 2) providing further coordination concerning construction-related issues; and 3) responding to expressed concerns about existing arena impact (residential area parking, post-event crowd behavior) on local neighborhoods. In addition, the project proponent has been an active participant in addressing many of the issues related to the development of other area projects.

PUBLIC FINANCIAL ASSISTANCE

At this time, the project proponent does not anticipate seeking assistance for the New Boston Garden Development from any governmental agency or funding program.

SUMMARY OF ENVIRONMENTAL ISSUES

This section summarizes the key environmental issues, analyses conducted, probable project impacts, and proposed measures to mitigate any adverse impacts associated with the new Boston Garden Development. With the implementation of the proposed mitigation measures, neither the construction nor operation of the New Boston Garden Development will result in significant environmental impacts to the project site and area. The impacts of the New Boston Garden, a replacement facility for the existing arena, will be minimal. Chapter IV and the Technical Data appendix should be referred to for a more detailed discussion of this material.

Transportation

From an access perspective, the New Boston Garden Development is in an excellent location. The project site is close to the regional highway system, and commuter rail and rapid transit facilities. Access to the site will be greatly improved as the result of planned transportation improvement projects by various public agencies. These improvements, particularly the Central Artery project, will expand roadway capacity and reduce traffic on the local street system. They will also enhance site access to the regional highway system and limit the addition of project traffic to area intersections. Project-generated traffic will be minimized by the extensive use of public transportation, which is characteristic of the area, and by the proponent's efforts to support transit use and encourage greater ridesharing. In addition, the proposed development will provide substantial enhancements to the pedestrian environment adjacent to and within the project site.

A detailed traffic analysis was conducted at twelve signalized and two unsignalized intersections near the site. The study found that the replacement of the existing Boston Garden with the New Boston Garden is expected to cause only minor changes in areawide traffic conditions during peak hours.

The findings indicate that three signalized intersections in the morning peak hour and three signalized intersections in the evening peak hour will operate at a deficient level of service (LOS) in 2000 and will experience significant project impacts on delay or volume-to-capacity ratio. With one exception, the mitigation measures proposed by the proponent will result in a higher level of service than under No-Build conditions. For unsignalized intersections, level-of-service changes at one location in the morning peak hour from E to F in 2000 with the project in place. In the evening peak hour, one location which is deficient under No-Build conditions will experience a large decline in available reserve capacity under Build conditions.

The project will provide an 1,100-space underground parking garage, which will be opened by late 1995. Project parking demand is expected to be less than the garage capacity in 1995, but off-site parking demand is expected to exceed the area supply because of the loss of several hundred spaces due to construction of the Central Artery. As a result, the 308 excess spaces in the project Garage will be available to ease the area shortage. By 2000, some of the spaces lost during Central Artery construction will be replaced and the off-site deficit will be eliminated. Completion of the project in 2000 is expected to result in an on-site demand greater than the project supply. This is in keeping with the City's desire to encourage and emphasize public transportation options. The analysis indicates that a modest increase in the areawide vehicle occupancy rate would eliminate the deficit.

Regarding public transportation, the project transit impacts will be accommodated by an ongoing program of fleet expansions and service improvements by the Massachusetts Bay Transportation Authority that will result in peak hour rapid transit capacity that is greater than projected system volumes under both 1995 and 2000 Build conditions. New commuter rail platforms and a direct connection to the new MBTA rapid transit Orange Line and Green Line station to be provided on site will enhance access to public transportation throughout the North Station area. Impacts on commuter rail and bus systems are expected to be minor.

Pedestrian facilities will have the capacity to accommodate project demands. Because of the arena's increased seating capacity, the New Boston Garden will generate new pedestrian trips, principally during the pre-event peak hour. However, a number of changes in site conditions will result in a reduction in the number of pedestrians approaching the site from along or across area streets as compared with existing conditions. A greatly improved pedestrian environment will be established in the area as a result of the Public Concourse provided within the project, a widened sidewalk along Causeway Street, and the removal of the overhead MBTA Green Line along Causeway Street and Lomasney Way. Further, on-site access to the Orange and Green Lines will reduce pedestrian crossings of Causeway Street, improving pedestrian safety.

The project will also provide greatly improved loading facilities for the arena, including a ramp directly to the arena floor from Nashua Street and a loading area off Accolon Way. A major improvement will be the provision of off-street space for buses and media vehicles which currently use Causeway Street. Loading for the commercial component of the project will be provided below grade and will contain sufficient area to allow for off-street maneuvering.

An extensive transportation mitigation plan is proposed to address several issues, including travel demand management, public transportation, parking management, access and circulation, loading, pedestrian improvements, roadway improvements, construction traffic management, access goals, and monitoring. The program goals are to reduce project peak hour traffic by encouraging transit use, ridesharing, and alternative travel times; to manage project construction impacts on the transportation system; and to provide access goals and a program to monitor performance.

Air Quality

A microscale carbon monoxide (CO) analysis was conducted at various intersections in the vicinity of the proposed New Boston Garden Development. Ambient air quality at nine intersections in the vicinity of the site was calculated under five different analysis conditions: the 1990 Existing, 1995 No-Build, 1995 Interim-Build, 2000 No-Build, and 2000 Full-Build conditions. Traffic volumes and vehicle speeds for peak 1-hour and 8-hour conditions were combined with worst case meteorology to predict maximum 1-hour and 8-hour CO concentrations. The modeling methodology was approved by the Massachusetts Department of Environmental Protection (DEP) and the Boston Redevelopment Authority.

No violations of the 1-hour CO Massachusetts and National Ambient Air Quality Standards (NAAQS) were predicted at any of the nine intersections for the 1990, 1995, or 2000 analysis conditions. The modeling results indicate that 8-hour CO concentrations may currently exceed the 8-hour NAAQS for CO at four intersections; however, future improvement in air quality is anticipated, due to lower predicted CO emission rates from vehicles. The model predicts violations of the 8-hour NAAQS for CO at only two intersections in 1995 under both the No-Build and Interim-Build conditions, (the latter includes the New Boston Garden) without the application of mitigation measures. The analyses indicate that project traffic under 1995 Interim-Build conditions will add only slightly to maximum 8-hour CO levels and will not have a significant impact on the attainment of applicable standards. For the Full-Build scenario in 2000, the model predicts compliance with both the 1-hour and 8-hour NAAQS for CO at all nine intersections.

Mitigation measures were identified to improve air quality, as well as to improve intersection operations, at the study area intersections that were predicted to exceed the 8-hour NAAQS for CO. In particular, at the intersection of Causeway Street, North Washington Street, and Commercial Street, recommended signal timing changes will improve air quality in 1995 to demonstrate compliance with the standards. At City Square in Charlestown, a recommendation regarding the location of new land uses, once the CANA project is completed, is included. The modeling results, in conjunction with implementation of these mitigation measures, indicate that the proposed New Boston Garden Development project will be in compliance with both the 1-hour and 8-hour NAAQS for CO for all future design years.

There are no parking garage-related air quality impacts for the new arena because this component of the project does not include a garage. A new underground parking garage is proposed as part of the commercial component of the New Boston Garden Development. An analysis of worst case CO concentrations both inside the New Boston Garden Development parking Garage and at sensitive receptors near its exhaust vents was conducted. This analysis, which included the effects of the MBTA underground garage as a background condition, indicates compliance with the US Environmental Protection Agency (EPA) guidelines for air quality inside the project Garage and the NAAQS for CO outside the Garage.

Since the New Boston Garden will be constructed above a pre-existing at-grade slab and will not require excavation, construction of the New Boston Garden will not have any air quality impacts other than temporary impacts associated with exhaust from construction vehicles on-site and vehicles traveling to the site. Emissions of particulates during construction of the commercial component will be controlled through a program of proposed mitigation measures. As a result, particulate concentrations are expected to remain in compliance with the NAAQS during the construction period.

Noise

A noise analysis was conducted to predict any long-term noise increases from project-generated traffic and from building mechanical equipment. Ambient noise measurements were made at five sensitive receptors in the project area to establish 1990 Existing conditions. The noise increases from project-generated traffic and the project's mechanical equipment were modeled at these receptors for the 2000 No-Build and Full-Build conditions. Mechanical equipment noise is limited by both the City of Boston and the Massachusetts DEP regulations. There are no regulations which apply to the project for roadway noise. Instead, the peak hour noise levels at the five sensitive receptors were compared to the Noise Abatement Criteria (NAC) guideline used by the Federal Highway Administration to determine whether noise levels in a commercially developed area are excessive and may require mitigation.

The modeling results show that both the New Boston Garden and the commercial component will fully comply with all noise regulations. Predicted peak hour noise levels may exceed the NAC for outdoor activities at some receptors for both the 2000 No-Build and Full-Build conditions. However, none of the future peak hour noise levels above the NAC for outdoor activities are caused by the project. None of the future noise levels exceed the NAC for indoor activities. The project will increase noise levels no greater than 1.4 dBA for the Full-Build condition. These increases are considered too small to be perceptible and are considered insignificant. As a result, no noise mitigation measures are expected to be required for either the New Boston Garden or the commercial component.

Visual Quality

The visual and aesthetic quality and urban design issues associated with the New Boston Garden Development were assessed using computer-generated, three-dimensional project views from nine representative, publicly-accessible pedestrian vantage points surrounding the site. Consideration was also given to the relationship of the height and massing of nearby buildings to the Full-Build project, and to the internal relationship of the buildings within the complex.

The proposed project site was evaluated in terms of the following urban contexts: the project site; the Bulfinch Triangle, West End, Government Center, and North End neighborhoods; and design parameters set by the zoning for the site and area. Consideration was given to the pedestrian environment linking the project elements.

Results of the analysis indicate the following visual quality benefits to the site and environs based on the development of the proposed project: creation by the New Boston Garden Development of a gateway to the city at North Station; definition of a new street wall on Causeway Street that is consistent with the height and character of the existing North Station and Bulfinch Triangle; creation of a visual focal point from Canal Street by the Public Concourse and new signage; creation of an interesting skyline with varied building heights and tops; transformation of the Causeway Street pedestrian environment due to the project; facilitation of the MBTA's, removal of the elevated Green Line; and street improvements which will dramatically enhance the visual quality of the area; transformation of a desolate parking lot into an active commercial area and pedestrian access way; and creation of an important pedestrian destination point.

Historic Resources

This Draft EIR/PIR provides detailed information on the history of the site, a discussion of the historic resources of the surrounding areas, and an evaluation of the effects of the New Boston Garden Development on historic resources at the site and in the vicinity. In 1983, the Massachusetts Historical Commission deemed the Boston Garden/North Station building ineligible for National Register listing or protection as an historic resource on the State Register of Historic Places. This was due to the deteriorated condition of the building and to the renovations and improvements made to the building, and which have diminished its historical value.

The existing Boston Garden/North Station building was constructed in 1927 and 1928 to replace Union Station. The facility was originally designed to accommodate 80,000 passengers a day in the station terminal area, and to host over 14,000 patrons at sports and entertainment events. Boston Garden/North Station is located in the vicinity of two historic districts, the Bulfinch Triangle Historic District, and the Charles River Basin Historic District. In addition, the North Washington Street Bridge (Charlestown Bridge) to the east of the project site, has been determined eligible for inclusion on the National Register of Historic Places by the Massachusetts Historical Commission.

The New Boston Garden will have minimal impacts on historic resources since the design of the New Boston Garden Development was developed with careful consideration of the adjacent historic districts, incorporating design features which reflect the historic character of the area. The New Boston Garden incorporates architectural elements reminiscent of the existing Boston Garden, but it is also designed as the northern gateway to the city. As presently conceived, the massing of the commercial component is intended to reflect the diversity of buildings in the project Triangle area. A Public Concourse, pedestrian arcades on Causeway Street, and a well-planned system of connecting pedestrian walkways will preserve the historic use of the site, benefit the public and respect the many historic resources in the area.

Tidelands and Public Purpose

The New Boston Garden Development is located on land which constitutes filled tidelands, but which is considered to be landlocked by the Massachusetts Department of Environmental Protection (DEP). The New Boston Garden Development lies landward of the Central Artery ramps and does not require a Chapter 91 license. DEP has been requested to provide a determination as to whether another parcel of filled tidelands, proposed for use as a storm drain, will require a Chapter 91 license. Construction of a new storm drain on this parcel of filled tidelands, owned by the Massachusetts Bay Transportation Authority, from which an easement will be requested, will result in a significant reduction in the amount of stormwater runoff from the project site and adjacent areas discharged to combined sewers, and will reduce the incidence and volume of combined sewer overflows. While a Chapter 91 license in not required for the New Boston Garden Arena, the New Boston Garden Development creates an important facility of public accommodation that is fully accessible. It also satisfies the proper public purpose and public benefit/detriment standards that would otherwise have applied if a Chapter 91 license were required.

Wind

A pedestrian-level wind study was conducted to assess, through the study of scale models in a wind tunnel, the wind conditions and wind comfort levels associated with the New Boston Garden Development. Wind conditions were analyzed for Existing conditions (1990), the New Boston Garden (1993), Interim-Build (1995), and Full-Build (2000) conditions. The various analysis conditions were assessed with respect to the existing wind conditions and to the intended pedestrian use of the area. Analysis criteria included mean wind speed and effective gust criteria as required by the Boston Redevelopment Authority.

Over eighty individual sensor locations were tested. The study indicates that at most locations tested, wind conditions resulting from the New Boston Garden will be comparable to existing conditions, although there will be several locations that, without mitigation, would not be suitable for sitting, standing, or walking using BRA criteria or that would not satisfy the BRA's effective gust criterion. Conditions in 1995 showed some wind increases, and conditions in 2000 indicated improved pedestrian-level winds. In certain cases, increased wind activity was attributed to existing conditions, to the construction of other proposed developments in the vicinity, or to the removal or demolition of existing structures such as the elevated MBTA Green Line and portions of the Central Artery.

To improve pedestrian comfort in specific areas, various mitigation measures were designed and tested for the 1993, 1995, and 2000 analysis conditions. The proposed remedial devices include windscreens, trellises, canopies, and pennants, strategically located on or adjacent to the project structures, to mitigate probable wind impacts. Based on water flume modeling, with verification by wind tunnel testing, it was predicted that the proposed mitigation measures will be successful in improving the level of pedestrian comfort in problem locations. The wind screens and other mitigation measures will be designed and implemented in consultation with the BRA.

Shadow

A series of computer-generated shadow analyses were conducted for the New Boston Garden Development to predict and evaluate project-generated shadows. The analyses focus on net new shadow effects on: the project site, major pedestrian areas, and existing and proposed public open spaces such as the Metropolitan District Commission (MDC) parkland along the Charles River and the New Charles River Dam. The shadow analysis identifies the incremental effect of the proposed project buildings on the study area by comparison to shadows cast by existing and proposed surrounding buildings. Seasonal studies were conducted for the vernal equinox (March 21), summer solstice (June 21), autumnal equinox (September 21), and winter solstice (December 21) for morning, midday, and afternoon shadow conditions.

The shadow analyses indicate that there are limited project-related shadow impacts to major public and private open spaces. Shadow effects of the New Boston Garden were shown to be negligible. In general, the majority of project shadows will be cast on the surrounding public roadways and on the commuter rail tracks to the north of the site. During spring, fall, and winter mornings, shadows will be cast near the Registry of Motor Vehicles, the Massachusetts General Hospital parking area and the Spaulding Rehabilitation Hospital to the northwest of the site. Shadow effects on the MDC parklands along the Charles River are minimal. Portions of the New Charles River Dam, and the pedestrian walkway which crosses it, are predicted to be in shadow only during late winter afternoons. There will be no shadow impacts to the Bulfinch Triangle Historic District or to the North End.

Daylighting

A computer-based study of skyplane obstructed by a structure (or combination of structures) was conducted to assess daylight impacts of the New Boston Garden Development. The daylighting analysis compared 1990 Existing and 2000 Full-Build conditions at pedestrian-level observation points on Causeway and Nashua streets. As specified in the BRA scoping determination for the New Boston Garden Development, the elevated Green Line tracks were excluded from analysis of both Existing and 2000 Full-Build conditions.

The results of the daylighting analysis show that, as viewed from Causeway Street including Buildings B, C, the Public Concourse, and the New Boston Garden, daylight impacts from the New Boston Garden Development are only slightly greater (2 percent) than the effects of the existing Boston Garden. Daylight impacts from the New Boston Garden are minimal since the new arena is set far back from Causeway and Nashua streets. Overall, the proposed project including the New Boston Garden and commercial component, will result in a level of daylight obstruction comparable to or less than the average of most buildings in downtown Boston, and similar to the nearby Bulfinch Triangle area.

Infrastructure

The effects of the New Boston Garden Project on storm drainage, sanitary sewers, water supply, and energy systems in the area were evaluated. Consideration was given to the current operation of these systems and possible impacts resulting from the project. Measures which the proponent will incorporate into the project to mitigate environmental effects were identified.

The results of the analyses indicate that, in general, adequate systems exist to serve the New Boston Garden and commercial component of the project. The sewage flow from the New Boston Garden will actually be less than the existing sewage flow from the existing Boston Garden and 150 Causeway Street which is anticipated to be demolished as part of the Central Artery project. As a result of the project, there will be many improvements to the design and operation of the area's utility systems which will provide positive benefits to the project area. The construction of the New Boston Garden will include the construction of a separate storm water drainage system, as requested by the Boston Water and Sewer Commission (BWSC). The new storm drain will address storm drain needs of the New Boston Garden Development as well as parcels owned by the Massachusetts Department of Public Works and MBTA, and will be maintained and operated by the proponent. The storm drain system will include an oil/water separator to remove sediments, oil, and grease from the discharge, and will contribute to the improvement in water quality of the Charles River.

Construction of of the New Boston Garden Development will include removal of stormwater flow from the combined sewer system which now serves the area. This will provide additional sewerage capacity, and water quality will be improved by removal of stormwater flow, since combined sewer overflows will be reduced. The project will also provide mitigation of inflow and infiltration to the sewer system at ratios far higher than the 2:1 ratio the Secretary of Environmental Affairs has previously held for certain projects in urban areas. Implementation of water-saving features and energy efficient design for the project will serve to reduce demand.

Water Quality

The principal effect of the project on water quality conditions in the Charles River and Boston Harbor will be an improvement in the quality of stormwater discharges and a substantial reduction in the volume of such discharges to combined sewers. Excessive stormwater currently flows into combined sewers and results in frequent sewage releases to receiving waters and consequent degradation of water quality. The New Boston Garden will provide separate storm sewers to direct site drainage to the Charles River and away from the combined sewers currently serving the site, decreasing the volume of drainage to the combined sewers which is currently generated on the site during storm events. Minimizing stormwater inflow into the combined sewer system and the removal of petroleum residues in stormwater released to the Charles River will provide water quality benefits. The frequency and volume of treated combined sewer overflows to the Charles River and Boston Harbor will decrease, thereby positively affecting the cleanup of the Charles River Basin and Boston Harbor.

Solid and Hazardous Waste

The analysis describes the types of waste materials which will be generated during construction and operation of the New Boston Garden Development are described in the Draft EIR/PIR. The existing Boston Garden contains various mechanical systems that utilize petroleum products or other standard materials which may be classified as hazardous. The demolition of the existing building and excavation for the proposed underground garage will be conducted in accordance with applicable federal, state, and local requirements for the handling and disposal of hazardous and solid wastes. Asbestos-containing material in the building will be removed prior to building demolition, in accordance with applicable state and federal regulations.

Solid waste generation associated with operation of the New Boston Garden will be similar to that of the current operation of the existing Boston Garden in terms of types of solid waste. The solid wastes generally include paper products, food service wastes, and office waste. Operation of the New Boston Garden will generate slightly higher amounts of solid waste, due to the increased size of the new facility. The New Boston Garden will include facilities to handle such waste in an appropriate manner in accordance with applicable requirements. The commercial component will generate solid waste typical of office, retail, and restaurant establishments. The proponent is committed to implementing waste minimization procedures and recycling where appropriate. No hazardous waste will be generated during the operation of the New Boston Garden or the commercial component.

Geotechnical Conditions

Geotechnical impacts associated with the New Boston Garden are minimal since the arena will be built in air rights above the MBTA underground garage and will be supported by the foundations of the MBTA garage. The northeast corner and the east wall of the New Boston Garden will extend beyond the MBTA garage, requiring foundations installed separate from those of the MBTA garage. These foundations are expected to consist of rock-socketed caissons, the installation of which may require drilling through those pile caps of the Anelex Building that extend beyond the face of the building. This will have no impact on the structural integrity of the Anelex Building.

Buildings B and C and the Public Concourse will be built above the six-level underground project Garage, which requires excavation to approximately 65 feet below existing grade. Foundations will consist of rock-socketed caissons and slurry walls bearing on bedrock. Foundation construction for the underground garage is expected to utilize the "up-down" technique which is being used in the construction of the adjacent MBTA North Station underground garage. In comparison to other techniques, up-down construction minimizes ground movements (settlements) and the lowering of the groundwater table in areas surrounding the construction site. This construction method also shortens the overall construction period by allowing construction of the building superstructure simultaneously with the construction of the underground garage.

Foundation construction associated with construction of the New Boston Garden Development is not expected to adversely impact existing structures or groundwater conditions in the area of the site. A construction monitoring program will be developed in consultation with the City of Boston, to assure prompt response to any ground movements or lowering of the groundwater table through implementation of pre-planned remedial measures.

Construction

Construction of the New Boston Garden Development--scheduled to begin in mid-1991 and to be completed in late 2000--will occur simultaneously with several major public works construction projects. On the same site as the New Boston Garden Development, the MBTA is building an underground parking garage, and a new commuter rail station at North Station. This project will include extension of the commuter rail tracks and raising of the platforms. In addition, the MBTA plans to relocate the Green Line to an underground alignment between Haymarket Station and the elevated tracks near the Registry of Motor Vehicles approaching Science Park Station. The Green Line tunnel will run beneath Building C and the New Boston Garden, through levels two and three of the underground project and MBTA garages.

In addition to the projects occurring on-site, several major roadway construction projects are scheduled to be undertaken in the vicinity of the site. These include depression of the Central Artery, improvements to Causeway, Nashua, and Merrimac streets, and removal of the elevated Green Line.

Construction of the New Boston Garden will involve construction-related traffic and equipment operations on-site which will be addressed through a construction mitigation program. The New Boston Garden will have minimal air quality effects from truck traffic, nor will it have significant geotechnical impacts since it will not involve excavation.

Detailed Construction Management Plan(s) including Traffic Maintenance Plan(s) will be prepared for the new arena and the commercial component and submitted to the Boston Transportation Department. These plans will address site access, access to public ways, construction techniques, proposed on-site and off-site staging, proposed truck routes and location of remote staging areas, construction schedules and hours of operation, construction operations, travel and delivery of materials and personnel to the project site, and measures to protect public safety. The construction management plans will be compatible with the construction sequencing, staging, and mitigation of approved Construction Management Plans of other area projects.

Measures to mitigate short-term impacts associated with construction include: erection of protective barriers around demolition and construction sites; provision of safe pedestrian access by means of walkways, signage, and fences; provision of adequate storage areas for materials; control of fugitive dust through water spraying; and implementation of a construction monitoring and rodent control program.

II Project Description

GOALS OF THE PROJECT

The New Boston Garden Development has been planned to create a new arena and commercial development which will assist in the revitalization of the North Station area of Boston. The project is a key element in the achievement of the City's North Station Urban Renewal Plan. The arena design is consistent with the recent zoning for the area establishing the North Station Economic Development Area (EDA), while the commercial component will require zoning relief for building heights. The New Boston Garden Development will: replace an important, deteriorating civic facility with a multi-purpose, state-of-the-art sports and entertainment arena; create an active and economically viable commercial environment; and integrate, support, and enhance various public transportation projects in the area, creating a gateway to the City of Boston from the north. While the development plans for the arena, commercial component, and transportation facilities are the work of separate architects and other design professionals, the master planning efforts share common goals and objectives:

- To create an active reuse plan for part of the City of Boston, incorporating major public uses with civic and commercial uses consistent with public policies and goals for the area.

- To construct a modern, privately financed arena to serve as a suitable home for the National Hockey League Boston Bruins (Boston Professional Hockey Association, Inc.) and the National Basketball Association Boston Celtics (Boston Celtics Limited Partnership, Inc.) sports teams.

- To develop a commercial project which enhances North Station's role as the major transportation gateway from the north to downtown Boston by commuter rail, auto, and rapid transit.

- To stimulate the economic redevelopment of the North Station area of Boston through the creation of jobs, provision of linkage payments, and participation in the reconstruction of area infrastructure.

- To create a functionally and architecturally unified project which is compatible with adjacent neighborhoods, including the Bulfinch Triangle, North End, and West End.

- To minimize the environmental impacts of project construction and operation by commitment to an extensive set of mitigation measures, including coordination with other concurrent major infrastructure projects.

- To facilitate active, meaningful public and agency participation in the decision-making process for the various project components. Overall, plans for the project have benefited from an extensive interagency coordination process involving city and state officials. In particular, the MBTA and the Central Artery team have worked closely with the proponent to assume design coordination and to minimize construction disruption.

The following sections of this chapter provide: a review of the project's evolution; a summary of the development alternatives; discussions of the master plan, arena design concept, and commercial component guidelines; and a summary of public benefits.

EVOLUTION OF THE PROPOSED PROJECT

Planning efforts for the redevelopment of the North Station area, including consideration of renovation or replacement of the existing Boston Garden and North Station, were begun as early as 1960 by area merchants. By 1977 the Boston Redevelopment Authority (BRA) had become a leading proponent for economic redevelopment within the North Station area and was responsible for the conduct and preparation of numerous studies for various development alternatives. These planning documents included:

- The Stadium Complex, An Asset to Boston, Citizen Seminars, Boston College, College of Business Administration, 1966. This document summarized the Greater Boston Stadium Authority's recommendation that a complex including a 53,000-seat stadium with a retractable roof, a 21,000-seat arena, and a 5,400-space parking garage be constructed on forty-five acres of land on and adjacent to Boston's Fort Point Channel area.

- New Directions for North Station, Boston Redevelopment Authority, 1977. This report presented a short- and long-term development strategy for revitalization of the North Station area, including construction of a major office or trade center complex on the North Station site and major commercial development on parking lot parcels on Nashua Street.

- North Terminal Area Site Analysis, Metropolitan Area Planning Council, 1979. This report assembled data pertinent to the North Station site and explored a range of development options for the site to assist private and public sector planning for future development.

- General Services Administration/Federal Office Building - A Proposal for North Station, City of Boston, 1980. This proposal included the siting of an office building for the General Services Administration on Causeway Street, adjacent to the existing Boston Garden/North Station.

- Application for the North Station Commercial Area Revitalization District (CARD), Boston Redevelopment Authority, 1980. This document addressed possible development, rehabilitation, and revitalization of the portion of the North Station area south of Causeway Street, including the commercial core of the Bulfinch Triangle, through the designation of a Commercial Area Revitalization District (CARD).

- North Station Urban Renewal Project Interim EIR (EOEA #3728), Boston Redevelopment Authority, 1980. This study identified and evaluated the environmental impacts of proposed redevelopment of the North Station area as an urban renewal project.

- Development Plan for North Station District, Moshe Safdie and Associates, Inc. for the Boston Redevelopment Authority, 1981. This report outlined a variety of redevelopment strategies for the North Station area and detailed plans for one of those strategies. This grand plan included the creation of an island in the Charles River as the site for 1,100 housing units, a canal, a hotel and shops on the Charles River waterfront, and significant amounts of new commercial and office space surrounding a Rockefeller Center-style plaza in the vicinity of the existing Boston Garden.

- North Station Development Plan: A New Arena, Preliminary Report, Moshe Safdie and Associates, Inc. for the Boston Redevelopment Authority, 1981. This study identified and evaluated the opportunities for locating a new arena in the North Station area, including two options for construction of an arena behind the existing Boston Garden.

- Final Recommendation Report, Arena Committee, 1981. This proposal included the establishment of an arena authority with power to build, finance, own, and operate a multi-purpose arena and related parking facilities. Specifically, the proposal included the construction of a 16,000-seat arena behind the existing Boston Garden and 1,500 parking spaces adjacent to the arena.

- North Station Urban Renewal Project Draft and Final EIR/EIS (EOEA #3728), Boston Redevelopment Authority, 1982 and 1983. This study addressed the environmental impacts of the implementation of an urban renewal plan involving the construction of a new arena, a Federal office building, office and retail facilities, creation of an island in the Charles River for 1,100 residences, parking facilities, and transportation improvements.

- Massachusetts Convention Center Authority, Multi-Purpose Arena Feasibility Study, Summary of Findings, Phase I, Howard Needles Tammen & Bergendoff, 1984. This feasibility study evaluated ten alternative sites for a new or renovated multi-purpose arena in Boston. The study concluded that two sites--a Fort Point Channel site and the North Station site immediately behind the existing Boston Garden--were technically feasible and recommended that the North Station site be carried forward for further analysis.

- Business Advisory Committee to the Massachusetts Convention Center Authority, Summary of March 19th Meeting, 1985. This memorandum summarized the Committee's recommendation that the Greater Boston Chamber of Commerce Board of Directors support the construction of a new multi-purpose arena in Boston and the exercise of eminent domain powers to take property in the vicinity of the existing Boston Garden for such an arena.

- Testimony of Fred Hoskins, General Counsel, Greater Boston Chamber of Commerce, in Support of House Bill 5927, 1985. This testimony expressed the support of the Greater Boston Chamber of Commerce Board of Directors for construction of a new multi-purpose arena in Boston and the Board's conclusion that the most desirable location for such a facility was in the immediate vicinity of the existing Boston Garden.

- Development Design Guidelines: Nashua Street Parking Lot, North Station, City of Boston Public Facilities Department, 1985. This document requested proposals for a multi-use development on the City-owned Nashua Street parking lot at North Station, including a new or substantially renovated arena, office and retail space, a hotel, housing, and parking. The document specified design development guidelines and criteria for review of such development proposals.

- Report on Boston Arena Proposals, Boston City Council Committee on Planning and Development, 1986. This report reviewed two proposals for multi-use developments in the North Station area submitted in response to the document referenced above and made several findings and recommendations with respect thereto. Among these were recommendations that a new sports and entertainment arena be constructed in Boston and that the Nashua Street parking lot be sold or leased by the City only to accommodate a new arena.

- Article 27D of the Boston Zoning Code, Downtown Interim Planning Overlay District, BRA, 1987. This article established interim zoning for the Downtown Interim Planning Overlay District (IPOD). Some of the purposes of the IPOD were to: channel new development to underutilized sites; encourage new developments in areas accessible to transit; create active pedestrian and street life; provide for appropriate transitions in scale between established districts and new development; and implement interim land use measures.

- Article 39 of the Boston Zoning Code, North Station Economic Development Area (EDA), BRA, 1989. This article establishes the zoning for the North Station Economic Development Area (EDA). Among its objectives are the creation of a northern gateway to the city by public transportation and automobile, and the creation of a mixed-use district including office, retail, research and development, biomedical, institutional, residential, sporting, and entertainment uses.

As indicated above, the BRA has played an active role over the years in creating, refining, and evaluating the impacts of development alternatives for the North Station area. This process led to the City's issuance of a request for proposals in the form of the document entitled Design Development Guidelines: Nashua Street Parking Lot, North Station which is described above. The development guidelines as set forth in the request for proposals required either a new or renovated arena, a housing component with 10 percent of the units affordable to low- and moderate-income residents, active retail uses, a daycare facility, and a minimum of 1,500 parking spaces. In addition, the guidelines required substantial pedestrian space to accommodate access to the mixed-use/arena development as well as to the MBTA transportation facilities, including a public concourse linking Causeway Street and the commuter rail platforms. The guidelines required that the development play a major urban design role in creating an appropriate gateway to the city. Further, the guidelines specified linkage payment and employment requirements which would apply to the development.

In response to the BRA's request for proposals, three development proposals were submitted containing data on building programs, design, financial feasibility, and environmental effects. One proposal, submitted by New Boston Garden Corporation and Lincoln Property Company, consisted of renovation of the existing Boston Garden and construction of an atrium retail complex, a hotel and housing complex, two office towers, and a 1,600-space parking garage. A second proposal, submitted by H.N. Gorin Associates, consisted of construction of a complex of buildings at the Nashua Street site, including a new arena, a hotel and residential tower, two office towers, and a 2,500-space parking garage. A third proposal involved the construction of a sports and entertainment center at the City's Southampton Street incinerator site.

In June 1986, after reviewing the proposals outlined above, the Boston City Council Committee on Planning and Development determined that the City deserved a new, modern, state-of-the-art arena to meet its sports and entertainment needs, and that renovation of the existing Boston Garden would be unsatisfactory. Consequently, the Committee recommended that the Nashua Street site which was subject to the 1985 request for proposals be sold or leased by the City only to accommodate the construction of a new arena. While the H.N. Gorin Associates proposal included the construction of a new arena, the Committee identified a number of factors precluding developer designation or endorsement of that proposal.

In July 1987, New Boston Garden Corporation (NBGC) submitted an alternative proposal for a multi-use development, including the construction of a new sports and entertainment arena, at and adjacent to the existing Boston Garden site. In June 1988, NBGC received notice of the City's intent to grant NBGC tentative designation as the arena developer. In January 1989, a Memorandum of Agreement (MOA) was reached between the City, the BRA, and NBGC outlining the building program. The agreement provides for NBGC to construct a new arena on air rights behind the existing Boston Garden and to develop 2.3 million square feet of commercial space on the site of the existing arena and adjacent parcels. In February 1989, a Memorandum of Agreement was also reached between New Boston Garden Corporation and the MBTA, providing for the cooperative development and coordination of the New Boston Garden Development and the MBTA's North Station Transportation Improvement Project. The planning and design of the New Boston Garden Development to date has proceeded on the basis of this agreement.

Thus numerous alternatives, both for development of this site and for development of an arena in Boston, have been considered and carefully evaluated by the BRA and other agencies and private parties over the past several decades. The designation of this site and this project is the culmination of this years-long consideration of alternatives.

The New Boston Garden Development proposal and the No-Build alternative are the focus of this Draft Environmental Impact Report/Project Impact Report (EIR/PIR). The two development alternatives addressed were determined as a result of the Scoping Determination issued by the BRA (August 18, 1989) and the Certificate of the Secretary of Environmental Affairs on the Environmental Notification Form (September 8, 1989) for this project. Existing conditions in 1990, and future conditions in 1995 and 2000, both with and without the project, have been analyzed.

No-Build Alternative

The No-Build alternative is included in this analysis to compare the effects of the proposed development with the effects of maintaining existing conditions on-site. This alternative assumes that no redevelopment activity will occur on the site of the existing Boston Garden/North Station. Existing site conditions are described in detail in Chapter III, Area and Site Description.

In addition to the continuation of existing site conditions, the No-Build alternative includes consideration of other projects proposed in the study area. These projects include various public works projects, as well as private developments. The largest of these projects is the depression of the Central Artery and the construction of a third harbor tunnel (CA/T project) proposed by the Massachusetts Department of Public Works. Presently, this project is undergoing review as part of the state and federal environmental review processes. A description of background development projects also is provided in Chapter III, Area and Site Description.

Briefly, existing site conditions consist of two acres of land containing the Boston Garden/North Station structure. This building was built in 1928 as part of a larger development which included the Hotel Madison (originally the Hotel Manger) to the west and the Anelex Building (150 Causeway Street, containing approximately 549,000 square feet) to the east. The Hotel Madison was replaced by the General Services Administration (GSA) Building in 1983. The Anelex Building is scheduled to be demolished in August 1992 as part of the Commonwealth's plans to depress the Central Artery. This alternative, therefore, assumes provision of a staging and storage facility with arena vehicular access to replace facilities and access currently provided by the Anelex Building.

Boston Garden is in need of considerable renovation and improvement, particularly in relation to the building's mechanical, electrical, plumbing, heating, air conditioning, and ventilation systems. Replacement of these facilities is infeasible. In addition, the existing commuter rail facilities provide poor connections between the platforms, the station, and rapid transit service, and have become inadequate to serve the ever-increasing commuter rail passenger loads.

Proposed Development

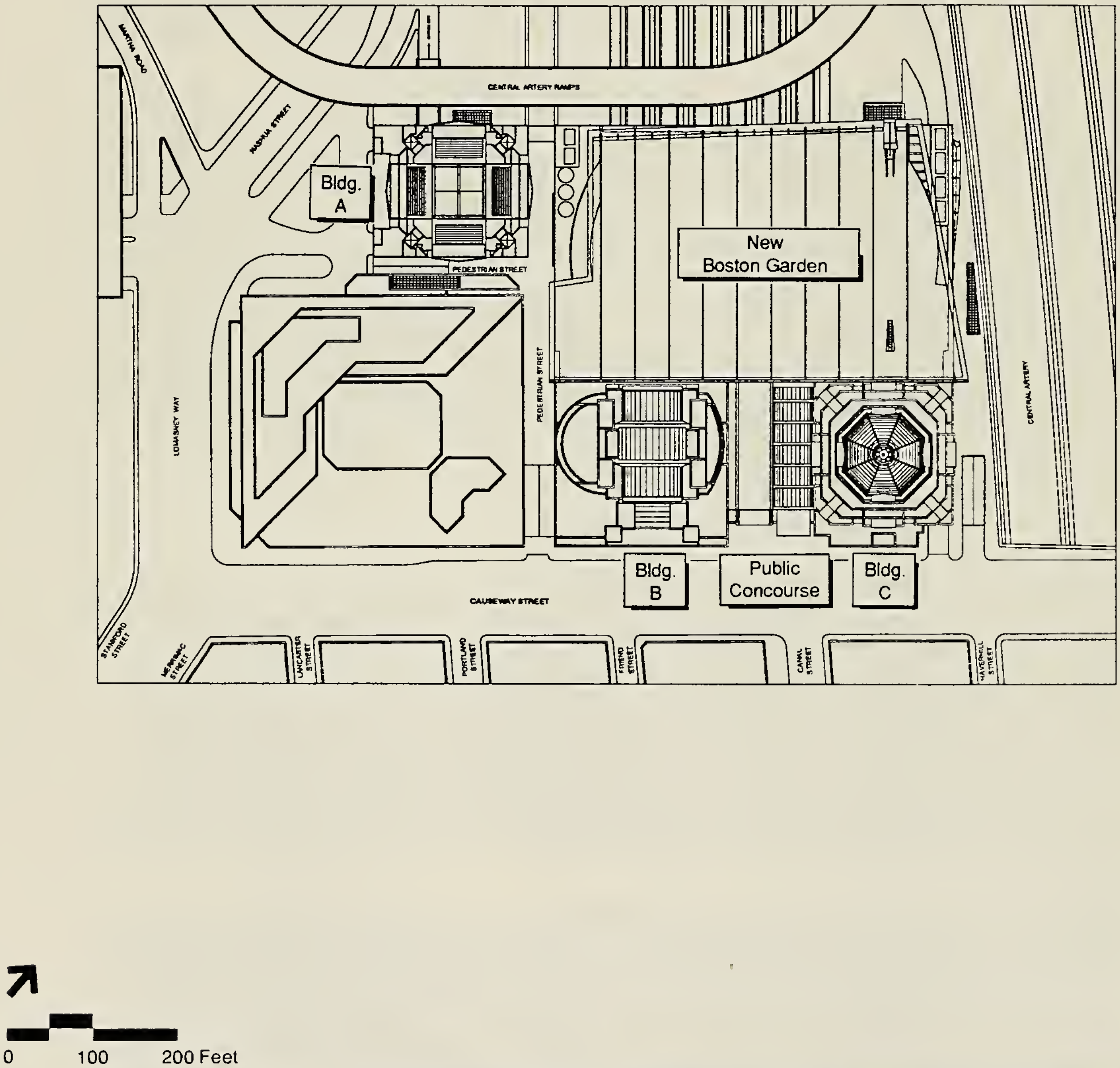
The New Boston Garden Corporation proposes to develop a privately financed, state-of-the-art arena and commercial development in Boston's North Station Economic Development Area--a district established by the Boston Zoning Code to channel development away from congested sites toward underutilized areas. There are three major elements of this development plan: 1) the New Boston Garden multi-purpose sports and entertainment arena built in air rights above the MBTA commuter rail tracks; 2) a Public Concourse serving a multi-modal transportation center (providing direct connections between commuter rail, rapid transit, and automobile parking); and 3) a commercial development which includes three office buildings providing first-class office space with an active retail base.

The New Boston Garden Development will significantly improve the existing functional relationship between the sports arena, transportation facilities, and commercial development in the North Station area. Direct connections between commuter rail, rapid transit, and automobile parking will be located on the ground floor of the new development, while the arena will be located above in air rights above the commuter rail tracks, as is the present functional organization of these two uses. Commercial office and retail space (totalling 2.3 million square feet within three office buildings) will provide an active economic element to the complex, much as the Anelex Building (150 Causeway Street) once did for the original 1928 development. Although the existing and proposed developments have common functional elements, the New Boston Garden Development will be of a larger scale and more modern design, and will provide a unique civic facility to the city.

Status of the Development Proposal

At this time, the New Boston Garden Corporation is the proponent of both the arena and the commercial component. It is anticipated, however, that in the future a joint-development partner for the commercial component will be announced. This anticipated action is reflected in the level of project detail provided in this Draft EIR/PIR. The planning and design of the New Boston Garden are well defined at this point, while the design of the commercial component is still conceptual. It is not the proponent's intent to present the design of the commercial component as definitive; rather, these plans provide a series of guidelines and design parameters which will be incorporated into the future plans of the three office buildings.

The level of design detail provided herein for the commercial component is sufficient to allow evaluation of the new arena plans while retaining the design flexibility which must be accorded the future development partner. The design guidelines for both the arena and commercial component have been derived through a variety of means, including: definition of site constraints; review of the Memorandum of Agreement between the New Boston Garden Corporation, the City, and the BRA; consultation with the MBTA concerning transportation access needs; consultation with the Central Artery team; review of the Boston Zoning Code; and collaboration between a master planning team and the architects for the New Boston Garden. These design guidelines and the proposed building program are outlined below in greater detail.



Vanasse Hangen Brustlin, Inc.

Site Plan

Figure II-1

The New Boston Garden Development will be a mixed-use development supporting an interactive mix of recreational/entertainment, commercial, and transportation uses. The project will create a northern gateway to the city, and will provide important public spaces and public benefits (see Figure II-1). The first phase of the project involves the construction of a new, privately-financed arena for sports and entertainment events, with a maximum seating capacity of 19,500 (the existing capacity is approximately 15,500 seats). The New Boston Garden will be located on a site immediately behind (north) of the existing Boston Garden and is planned to be open for the 1993 fall sports season.

The existing Boston Garden has played an important role in the social, cultural, entertainment, sports, and political development of the city. However, due to the changing needs of sports and entertainment events, the age of the building and its deteriorating condition, the need for a new facility has become critical. The New Boston Garden will be a replacement facility for the existing arena. It will remain in essentially the same Boston location and will provide an increase in seating capacity over the existing arena, ranging from 18 to 23 percent, for hockey and basketball, respectively. Unobstructed views, full accessibility, vertical transportation, air conditioning, and improved lighting, sound, and mechanical systems, and below-grade parking are only some of the amenities that will be incorporated into the New Boston Garden. Seating capacities in the New Boston Garden are proposed to be 17,091 for hockey games and 18,363 for basketball games, representing an increase of approximately 2,669 and 3,473 seats, respectively, for each event. Concerts, ice shows, circuses, and other entertainment events will have seating capacities ranging from 15,000 to 19,500. The new arena design will be optimal for concerts, as well as sports events, thereby providing a new in-town concert facility.

The new arena will be developed on air rights above commuter rail lines, which the MBTA plans to extend 275 feet south to the rear of the existing Boston Garden, and an underground parking garage (1,300 spaces) currently under construction by the MBTA. Additional improvements by the MBTA at the project site include the relocation of the elevated rapid transit Green Line on Causeway Street to an underground alignment through the garage. The arena floor will be located approximately 35 feet above the commuter rail tracks.

Upon completion of the new arena in 1993, demolition of the existing Boston Garden will begin to permit creation of new commercial development on the site. On Causeway Street this development will include two office buildings, an 1,100-space underground parking garage (functionally linked with the MBTA garage), and a grand-scale Public Concourse. This Public Concourse will serve as the primary access to the arena and MBTA train facilities, with secondary access between Buildings B and C. A third office building (Building A) will be constructed, fronting on Nashua Street, but with ancillary access provided through the Public Concourse on Causeway Street. The garage, Public Concourse, and Building C are scheduled to open in 1995. Building B is anticipated to be completed in 1998, followed by Building A in 2000. The proposed building program is summarized in Table II-1. The dimensions, square footages, and construction dates specified for the project herein are based on current plans. These parameters may vary somewhat as the planning of the project proceeds.

Table II-1 **BUILDING PROGRAM SUMMARY***

Use	Zoning Height (Feet)**	Gross Square Footage Office	Retail	Other	Total
Arena	162.5	--	--	755,500***	755,500
Public Concourse	55.0	--	--	16,000	16,000
Building A+	277.0	450,000	--	--	450,000
Building B+	425.0	844,000	39,000	--	883,000
Building C+	475.0	956,000	11,000	--	967,000
TOTAL	--	2,250,000	50,000	771,500	3,071,500
Parking Garage++	--	--	--	--	517,000

* The building program has been modified in certain respects from that specified in the ENF and PNF. In particular, the hotel space has been eliminated and there have been shifts in the location of office and retail space, with resultant changes in building heights. However, the total amount of space in the commercial component remains virtually unchanged.

** Represents zoning height to top of the highest occupied floor.

*** 19,500 seats (maximum capacity).

+ Buildings are in concept design stage and final height and program numbers may vary.

++ 1,100 parking spaces. Gross square feet includes MBTA Green Line tunnel.

The proposed New Boston Garden Development will help fulfill the goals of the North Station Economic Development Area by providing a unique, major civic facility and by promoting the creation and retention of job opportunities. The project will also contribute to the construction of several area infrastructure improvements.

The New Boston Garden Development has been designed to create a gateway to the city by commuter rail, rapid transit, and automobile. The proposed project will complement and be coordinated with the state's construction of a new Central Artery. The existing elevated Central Artery will be depressed through the downtown core of Boston. The northern portal for the depressed Artery will be located adjacent to the New Boston Garden Development at Causeway Street. As currently planned, the depressed Artery will climb from the portal, passing the New Boston Garden and Building C before ascending to its Charles River Bridge crossing. The Anelex Building (150 Causeway Street, now owned by the MDPW) will be demolished to accommodate the new Central Artery alignment. The north facade of the new arena will be bounded by elevated ramps from the Artery to Leverett Circle. Both the east and the north faces of the New Boston Garden Development will offer dramatic views to passing motorists.

Pedestrian access considerations have shaped the master plan for the development. For example, the existing conditions require commuter rail passengers transferring to rapid transit to walk several hundred feet from the train platform, pass through the Boston Garden/North Station Building, cross busy Causeway Street, and climb stairs to the elevated and exposed Green Line rapid transit station or descend below grade to the Orange Line station. In contrast, the New Boston Garden Development will create a partially enclosed train shed, providing direct access between the cross-platform (connecting all of the track platforms) and the Public Concourse serving the commuter rail lines. From the ground floor of Building C, escalators and elevators will carry passengers underground to a new superplatform to be constructed by the MBTA, serving both the Orange and Green rapid transit lines. Additionally, people parking within the MBTA or project Garage will be able to internally access public transportation from the ground floor for travel to other destinations, creating a multi-modal transportation center for automobile, commuter rail, and rapid transit travel.

Full public access will be provided at the ground floor of the New Boston Garden Development, including the Public Concourse, the office and retail spaces, and the arena. The Public Concourse will have generous proportions to accommodate a variety of pedestrian flows within and through the project site. Arena ticketing will occur off the Public Concourse, with access up to the New Boston Garden provided by means of escalators, elevators, and stairs. This concourse also will provide access to North Station ticketing facilities and to the cross-platform connecting the commuter rail tracks.

The New Boston Garden Development will facilitate pedestrian access from the North Station area and public transportation facilities to destinations north of the site. Pedestrian access will be provided between the train shed and Building A to the northwest of the site, and will provide links with pedestrian routes to the Spaulding Rehabilitation Hospital, Charles River Park, Massachusetts General Hospital, future development by Massachusetts General Hospital on Nashua Street, the Registry of Motor Vehicles, the Suffolk County Jail, and the banks of the Charles River.

ARENA DESIGN CONCEPT

The New Boston Garden will anchor one of the country's most innovative commercial developments and will help create a distinctive gateway to the city of Boston from the north. Due to a variety of site opportunities and constraints, the new arena will be nestled between three office buildings on its south and west sides and bordered by major elevated highways on its north and east sides.

Internal and external site constraints dictate that the new arena be organized vertically. The New Boston Garden will be built on the site of an underground MBTA public parking facility. Platforms for twelve commuter train tracks will be located at-grade above the garage, extending to the north face of the Public Concourse and to the two office buildings. The arena floor will be elevated approximately 35 feet above grade, constructed above the garage and tracks.

The construction of a new arena meets the standards of Article 39 of the Boston Zoning Code, which creates the North Station Economic Development Area (EDA). Consistent with this zoning, the New Boston Garden will be a major and unique civic facility serving Boston and the region. The arena will comply with the goals and use requirements of the EDA zoning, although no specific dimensional and design requirements are identified for an arena use.

Arena Description

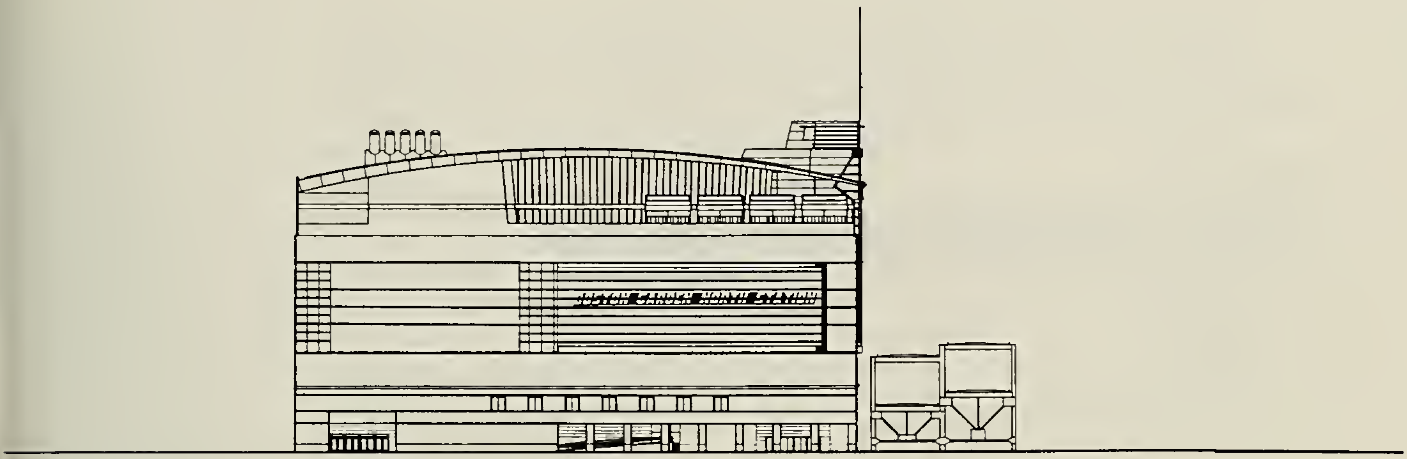
The form of the New Boston Garden has been shaped by several important factors. It has been designed to express its internal uses, to relate to the surrounding urban context, and to provide for the varied pedestrian flows through and within the project site. While the base of the New Boston Garden responds to immediate pedestrian, vehicular, commuter rail, and rapid transit requirements, the arena portion and roof respond to the larger urban context. An important design consideration has been to maximize the opportunity for patrons within the arena to orient themselves to the city. Large window openings will communicate internal activity, establishing a dialogue with the urban setting (see Figures II-2 and II-3).

Externally, the arena is divided into three vertically stacked components. The lowest component is the two-story base, demarcated by dark rough-hewn masonry, expressing the train, ticket, and office functions. Thirty-five feet above the street level, a distinct belt course delineates the arena floor, and the change in facade materials expresses the main body of the arena. The third and most dramatic layer is the long-span roof. The roof trusses, spanning north and south, are distinctly articulated as they meet the facade. The east and west ends of the arena below the cantilevered roof edges are free from the structural requirements of supporting the roof. In addition to providing differentiation of the roof levels, the ends provide optimal locations for cooling towers, microwave dishes, mechanical ventilation, etc., as well as echoing the form of the seating bowl inside.

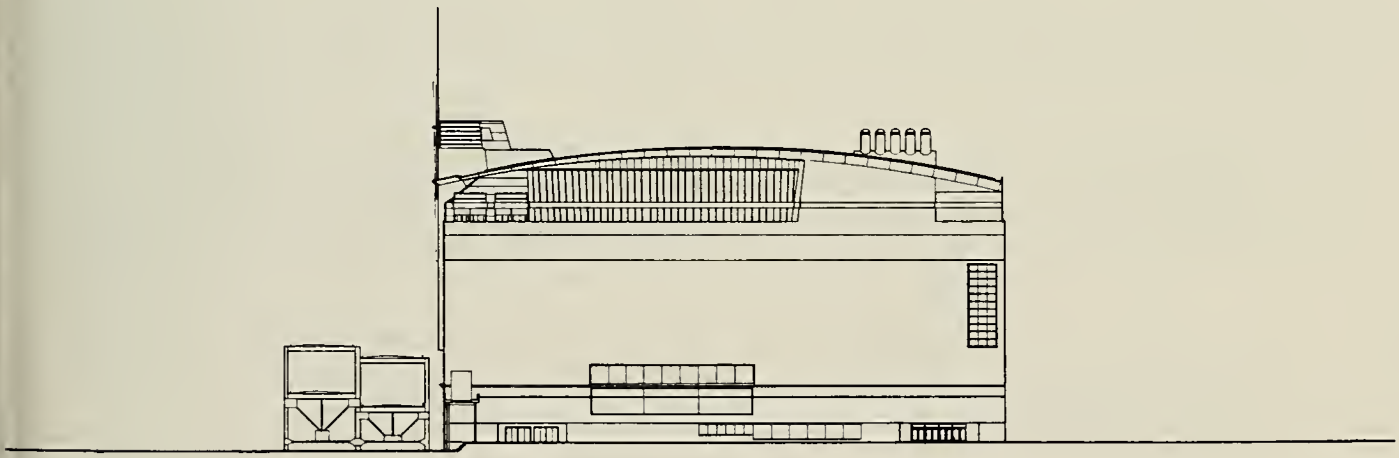
The northern approach of the Central Artery and the commuter rail lines, combined with the prominent exposure of the building from the north, establishes the New Boston Garden as a gateway structure. In response, the building has been designed as an asymmetrical composition whose focus is the northeast corner. An illuminated tower located there will serve as a beacon from a distance and will also be the most prominent element seen from the Central Artery Charles River Bridge before entering the depressed portion of the roadway.

The tower also serves as a terminus to a series of compositional elements which begin on the southeast corner of the arena. A major public stair located at this corner will be extensively used by patrons entering and exiting the arena. A four-story protruding window in the stair will provide views to Boston Harbor and southeast along the greenbelt above the future depressed Artery. Mirroring this element immediately to the north is a similar bay window which provides views from public food courts and private dining areas.

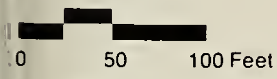
Beginning at the northerly bay window, continuing north, and finally terminating at the tower will be a curvelinear marquee. Semi-transparent in nature, the marquee will reveal motion and activity within the arena. Its perforated metal construction will create a play of light on the facade during the day and will be illuminated as a silhouette at night. The juxtaposition of the east roof edge responds to the larger urban context by being aligned with the Central Artery. The north roof edge follows this rotation, creating a sense of movement on the roof plane.



East Elevation



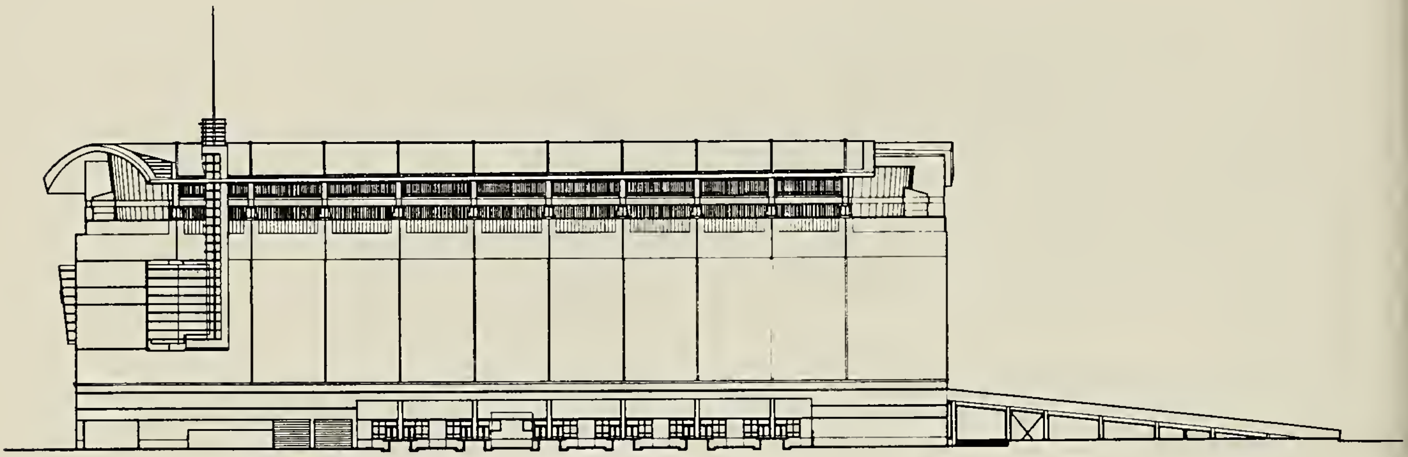
West Elevation



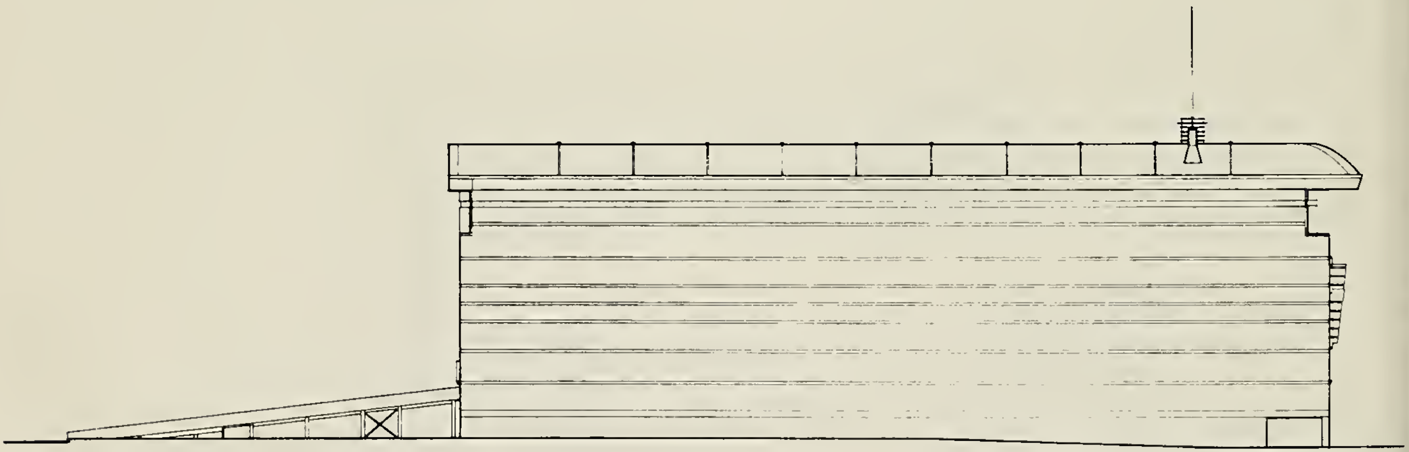
Source: Ellerbe Becket, Inc

Arena Elevations–
East and West

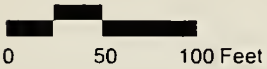
Figure II–2



North Elevation



South Elevation



Source: Ellerbe Becket, Inc

Arena Elevations–
North and South

Figure II-3

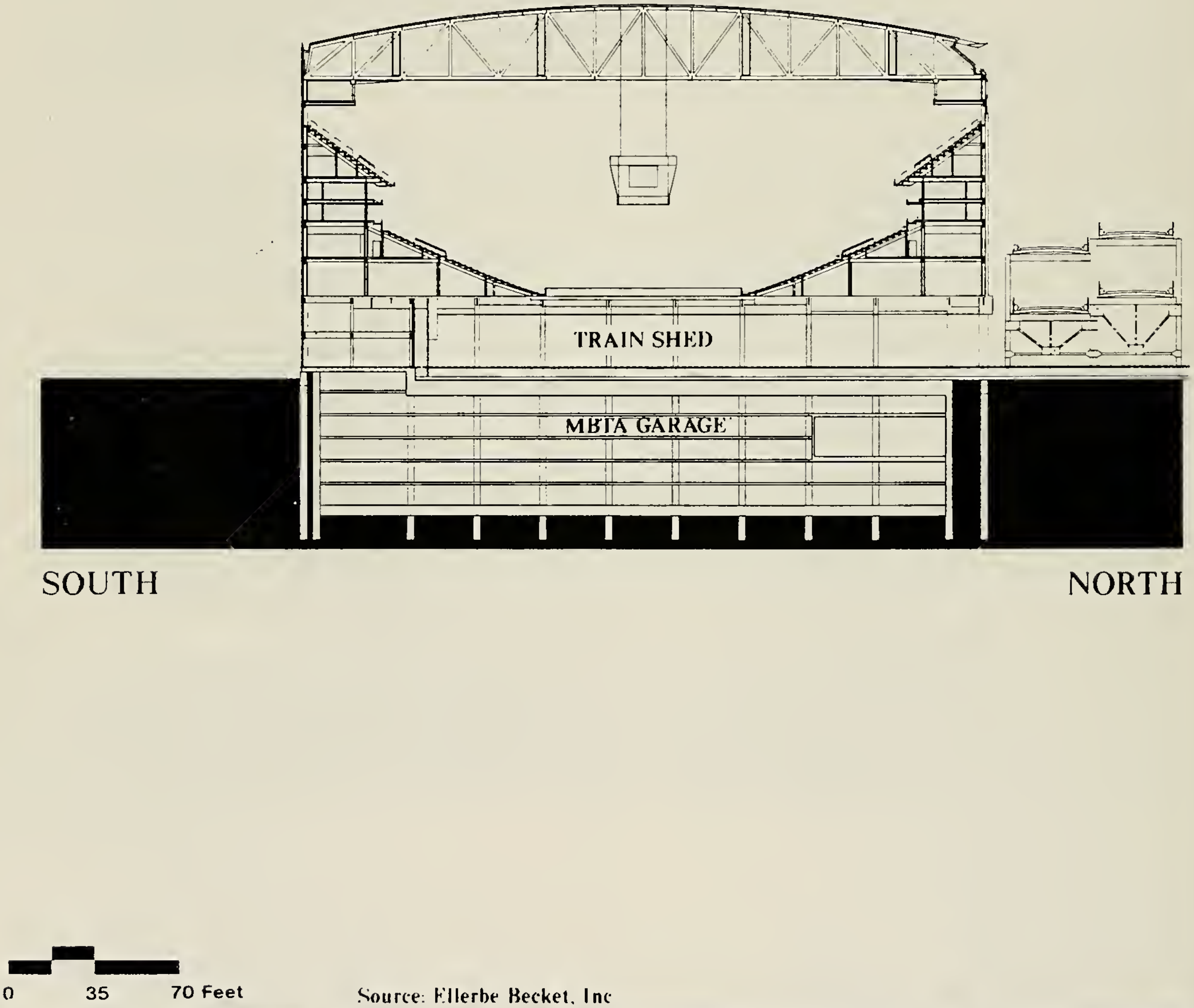
The Public Concourse, which provides an entrance from Causeway Street to commuter rail and rapid transit facilities and the arena, will be a transition element between the arena, the train shed, below-grade parking, future office and retail uses, and the historic Bulfinch Triangle area. This grand-scale public space will use escalators and elevators to transport patrons throughout the complex.

A total of ten levels (seven public levels) will be contained within the New Boston Garden, including two levels of support functions below the arena floor (east portion of footprint) and five seating levels. Figures II-4 through II-9 present cross sections and floor plans of the New Boston Garden. The interior of the arena itself will retain some of the more familiar aspects of the existing Boston Garden, including the championship banners hanging from the rafters and the parquet floor used for basketball. Other features, however, will be thoroughly modernized, including all electrical, mechanical, visual, and audio systems.

As noted earlier, seating capacities will be increased over those of the existing arena, but will still retain the proximity between the spectators and the performers. The New Boston Garden will seat 17,091 and 18,363 for hockey and basketball games, respectively. Concerts, ice shows, circuses, and other entertainment events will have seating capacities ranging from 15,000 to 19,500. The existing arena hosts approximately 210 events per year. In its first year after the 1993 opening, the New Boston Garden will host approximately 40 regular season hockey games, 38 basketball games, and 162 entertainment events (concerts, circuses, and other sports events) for a total of 240 events in its first year of operation. Increases in the number of annual events are projected for succeeding years, to a maximum of approximately 270 annual events.

One of the features of the New Boston Garden will be the premium seating levels. These levels include 104 executive suites (1,368 seats) and 2,124 club seats. Suite holders and club seat patrons will have access to a private club, parking facilities, and a variety of related amenities. Revenues from these seats will play an important role in the private financing of the arena project.

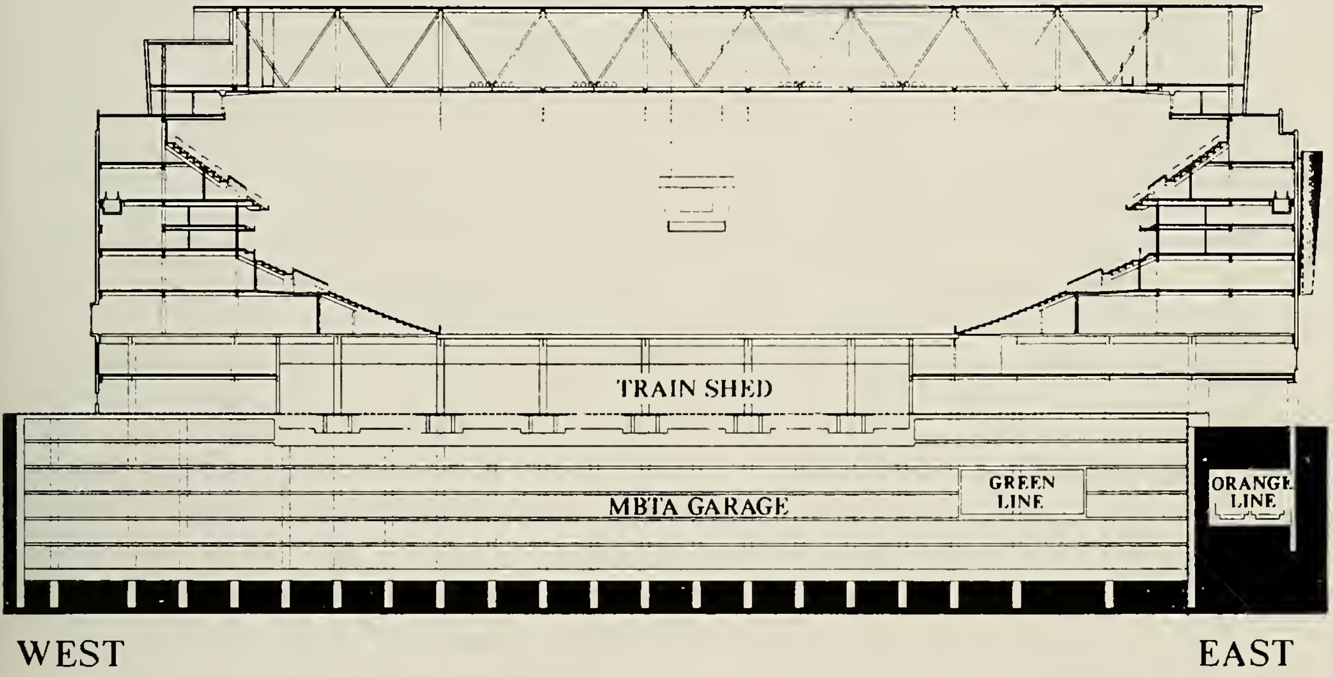
Spectator amenities will be provided on each public level of the arena. Numerous concession stands, food courts, novelty outlets, restaurants and clubs, and ample restroom facilities will be conveniently located. Wheelchair seating areas will be provided throughout the seating bowl. Ease of access to all areas of the arena have been a primary concern, with accommodations for the disabled carefully integrated into the design.



Source: Ellerbe Becket, Inc

Arena Section
Looking West

Figure II-4

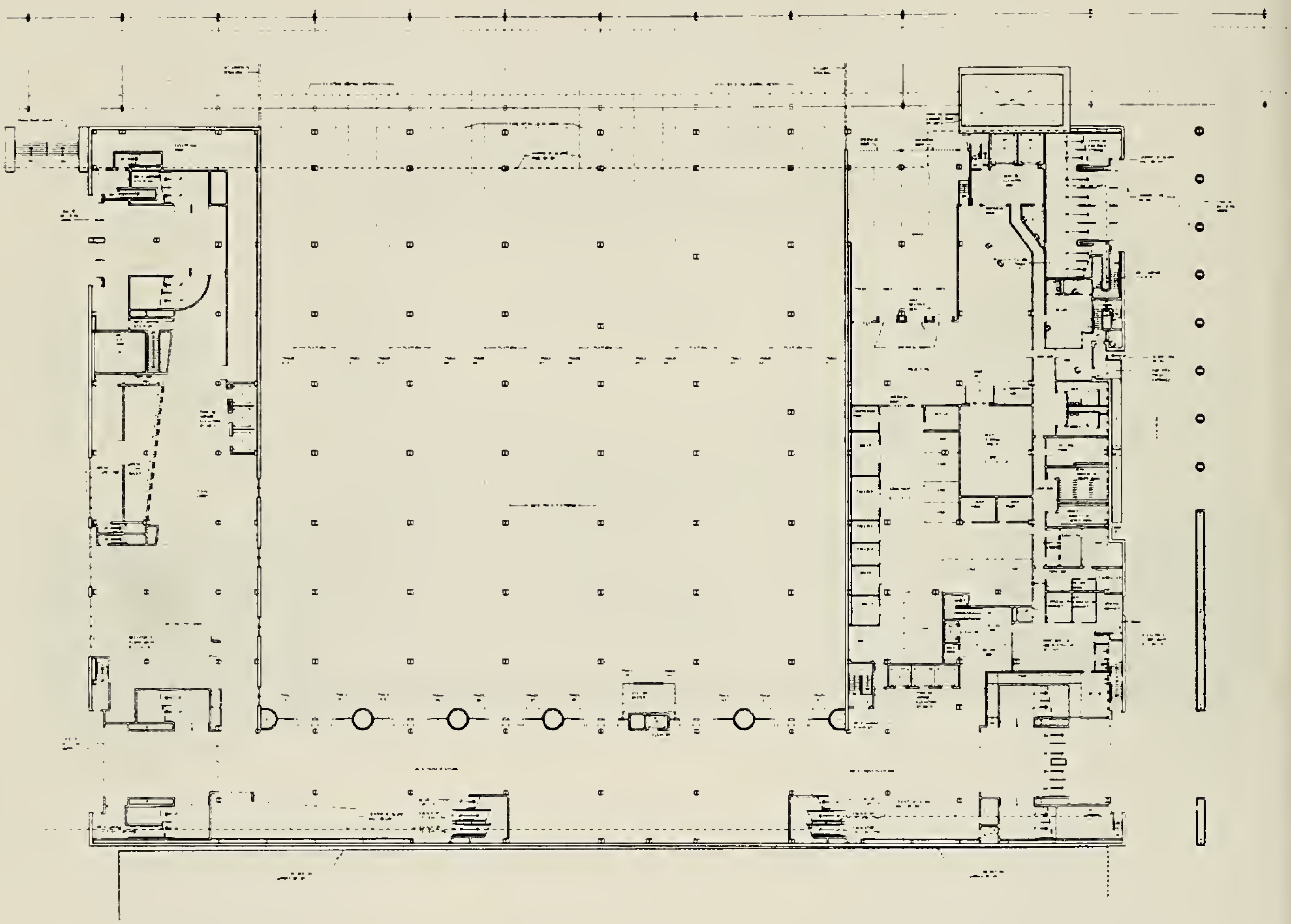


0 35 70 Feet

Source: Ellerbe Becket, Inc.

Arena Section
Looking North

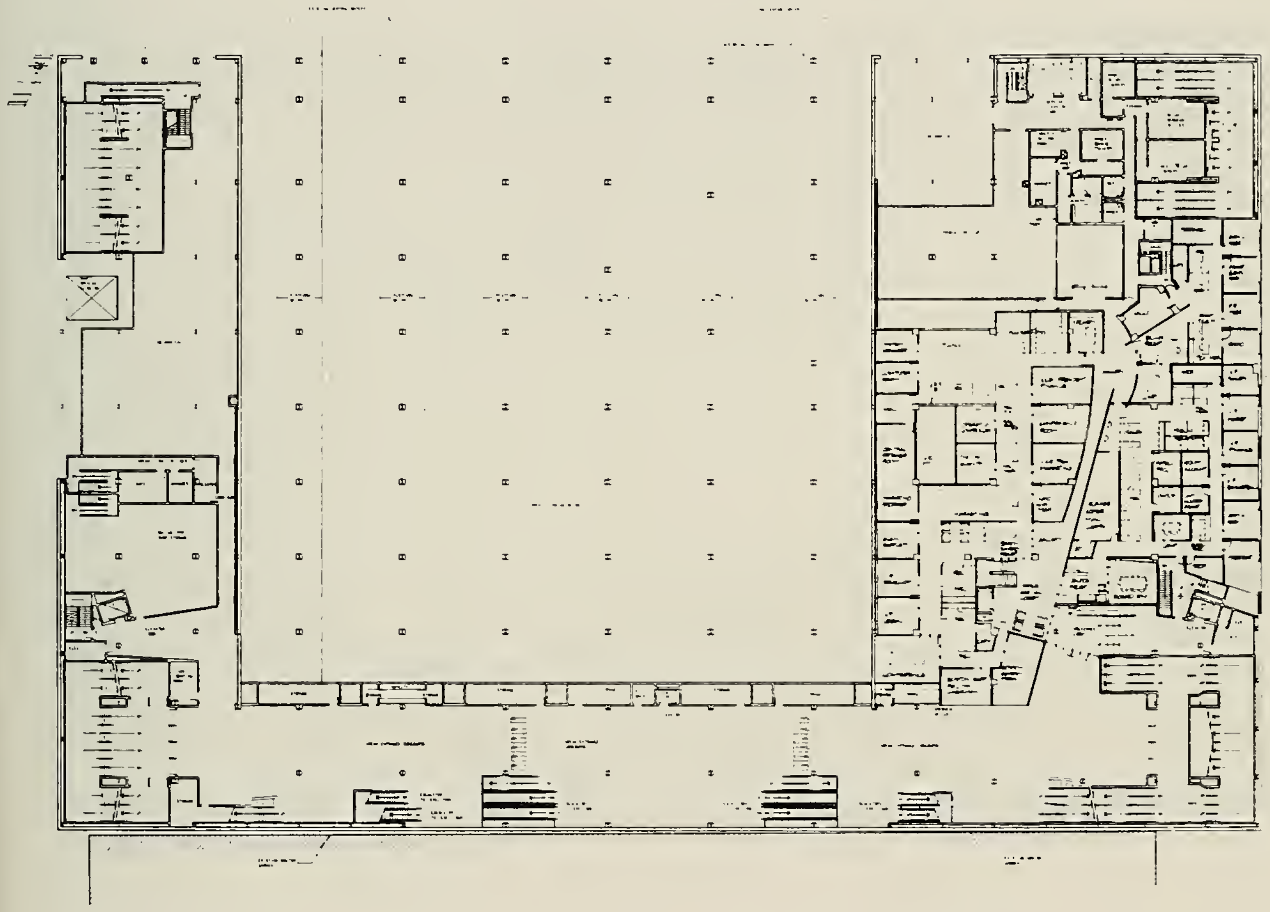
Figure II-5

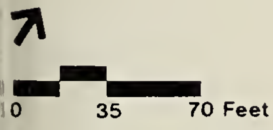


Source: Ellerbe Becket, Inc

Arena Ground Level

Figure II–6

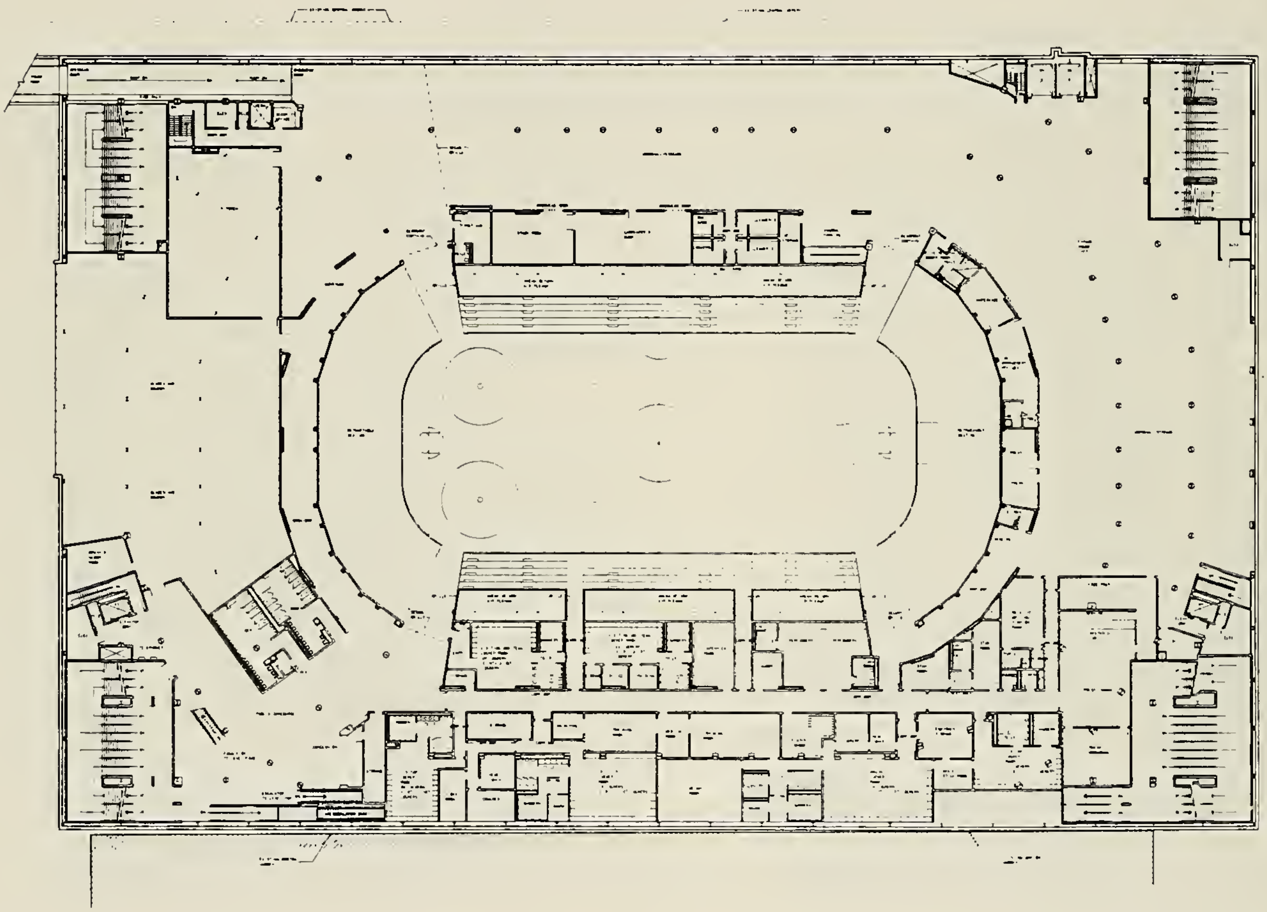


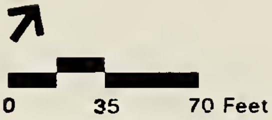


Source: Ellerbe Becket, Inc

Arena Entrance Level

Figure II-7

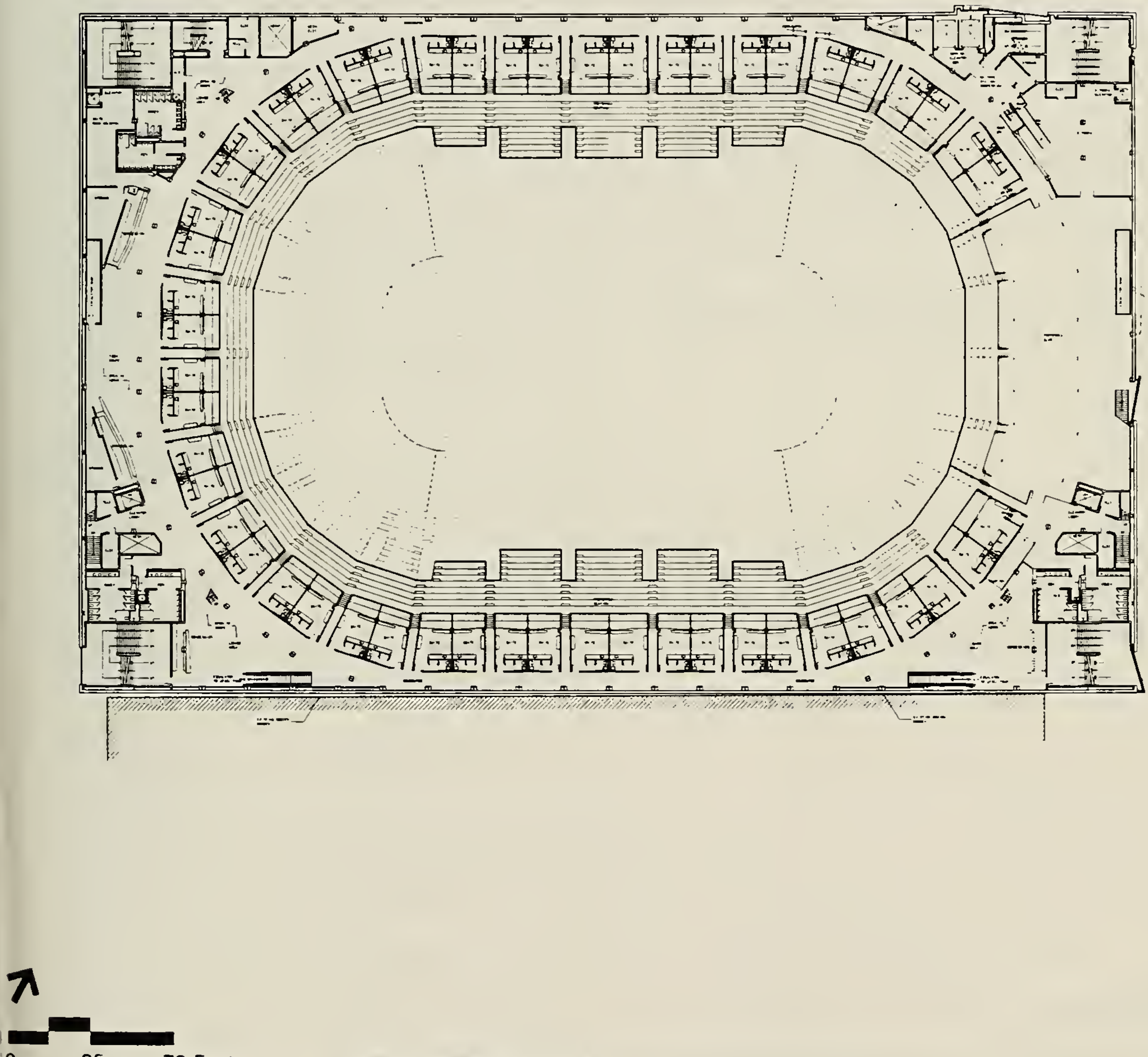




Source Ellerbe Becket, Inc

Arena Event Floor Level

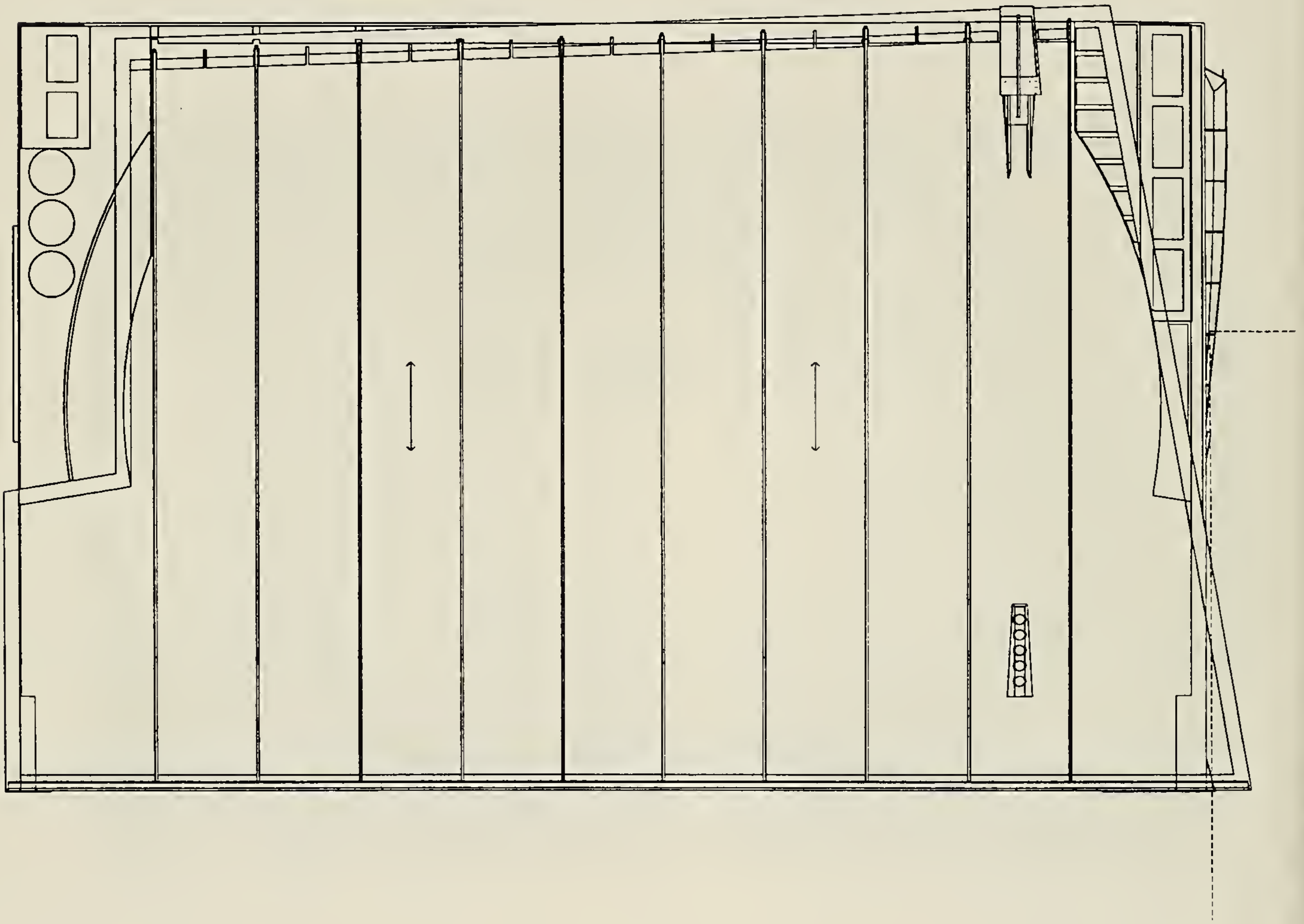
Figure II-8

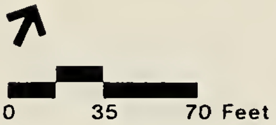


Source: Ellerbe Becket, Inc.

Arena Prefered Seating/
Lower Suite Level

Figure II-9





Source: Ellerbe Becket, Inc

Arena Roof Plan

Figure II-10

The arena will include necessary ancillary functions such as locker rooms and other administrative team offices. Service access will be provided by way of Accolon Way to loading docks on the north side. Storage will be accommodated at grade, east of the train shed area and on the arena event floor level. Tractor semi-trailers will have direct access to the arena floor and to an adjacent marshalling area by means of an access ramp from Nashua Street, through Building A to the arena floor, 35 feet above grade. These plans represent a significant improvement over current servicing operations.

High-quality materials will be used in the New Boston Garden. At this time, the base and body of the arena are proposed to be clad in premium architectural concrete masonry units; ground, polished, or rough-hewn to expose concrete aggregates. Windows are proposed to feature amber-colored glass. Window framing units will use special textured and colored metals to enliven the building surface. The areas above the masonry, but beneath the roof, will be executed in a variety of subtle metallic colors. The roof edge will be textured metal, emphasizing the dramatic cantilevers on the east, north, and west. Metal battens emphasize the truss line of the roof plane, completing what is considered the fifth facade of the building (see Figure II-10).

The architectural design of the New Boston Garden was presented to the Boston Civic Design Commission on May 1, 1990. The Commission voted unanimously to endorse the arena design.

COMMERCIAL COMPONENT DESIGN GUIDELINES

As noted previously, the design of the 2.3 million square foot commercial component is only conceptual for purposes of this Draft EIR/PIR. It is provided to allow full evaluation of the new arena plans, while retaining the design flexibility which must be preserved for the future development entity. However, certain design guidelines for the commercial development and for the project as a whole have been established. These guidelines have been influenced by a variety of sources, including:

- Article 39 of the Boston Zoning Code - North Station Economic Development Area
- The Memorandum of Agreement (MOA) between the City, the BRA, and New Boston Garden Corporation (NBGC)
- The Memorandum of Agreement between the MBTA and NBGC
- Consultation with the MBTA concerning transportation access needs
- Analysis of existing and future site opportunities and challenges
- Coordination between the New Boston Garden Development and MBTA garage design teams
- Operational requirements of both the commercial development and the arena

The overall development plan is the result of extensive discussions with the City, the BRA, and various state agencies. Once a development partner for the commercial component has been selected, specific design plans will undergo extensive review as part of the City of Boston zoning and design review processes. The conceptual plans for the commercial component are presented in Figures II-11 through II-16.

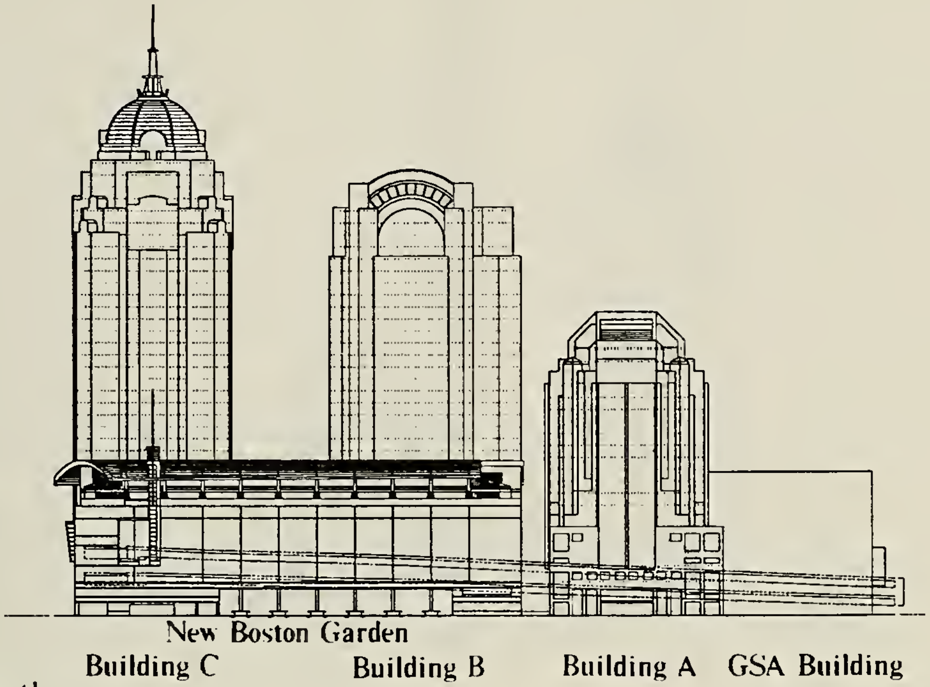
Project Zoning

The New Boston Garden Development lies within the North Station Economic Development Area (EDA), which encompasses an area bounded by Causeway Street to the south, the North Washington Street Bridge to the east, the Charles River to the north, and Martha Road and Lomasney Way to the west. Article 39 of the Boston Zoning Code sets forth the zoning regulations for the North Station EDA. Two areas within the North Station EDA are eligible for Planned Development Areas (PDAs): the New Boston Garden Development Area and the New Economy Development Area. The site of the New Boston Garden Development constitutes the bounds of the New Boston Garden Development Area, while the New Economy Development Area is located immediately to the north. The project proponent will propose the establishment of a PDA and will request approval of a development plan in accordance with Sections 3-1A(a) and 39-8 of the Code.

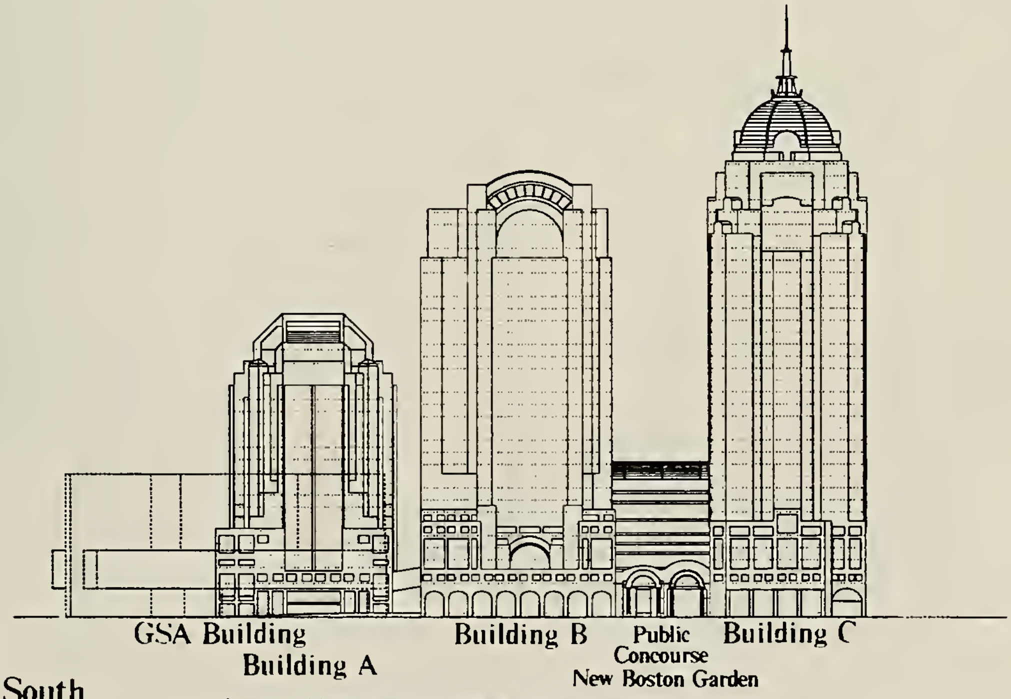
The design of the commercial component allows the project to support and further the policy goals of the North Station EDA as set forth in Article 39 of the Code. Among the primary goals and objectives of the North Station EDA are to:

- create a northern gateway to the city by public transportation and by automobile;
- direct downtown development in a way that promotes balanced growth for Boston and channels growth away from the congested center;
- create a mixed-use district which, among other uses, includes office, retail, and sports and entertainment uses;
- create a mix of facilities which will foster economic growth in Boston and throughout the region; and
- create a functionally and architecturally unified district which is compatible with the North End and Bulfinch Triangle.

The New Boston Garden Development will enhance North Station's image as the major transportation gateway to downtown Boston by integrating rail, auto, and rapid transit transportation from the north. The project will direct development away from the congested downtown area through the creation of a large, mixed-use development that is compatible with the surrounding areas and is directly accessible from the transportation facilities. Additionally, within the PDAs, Article 39 of the Code has established specific planning and development criteria. The proposed development plan for the New Boston Garden Development meets these criteria by providing "major, unique civic facilities, including a new indoor sports arena and the integrating elements of a multi-modal transportation center."



North

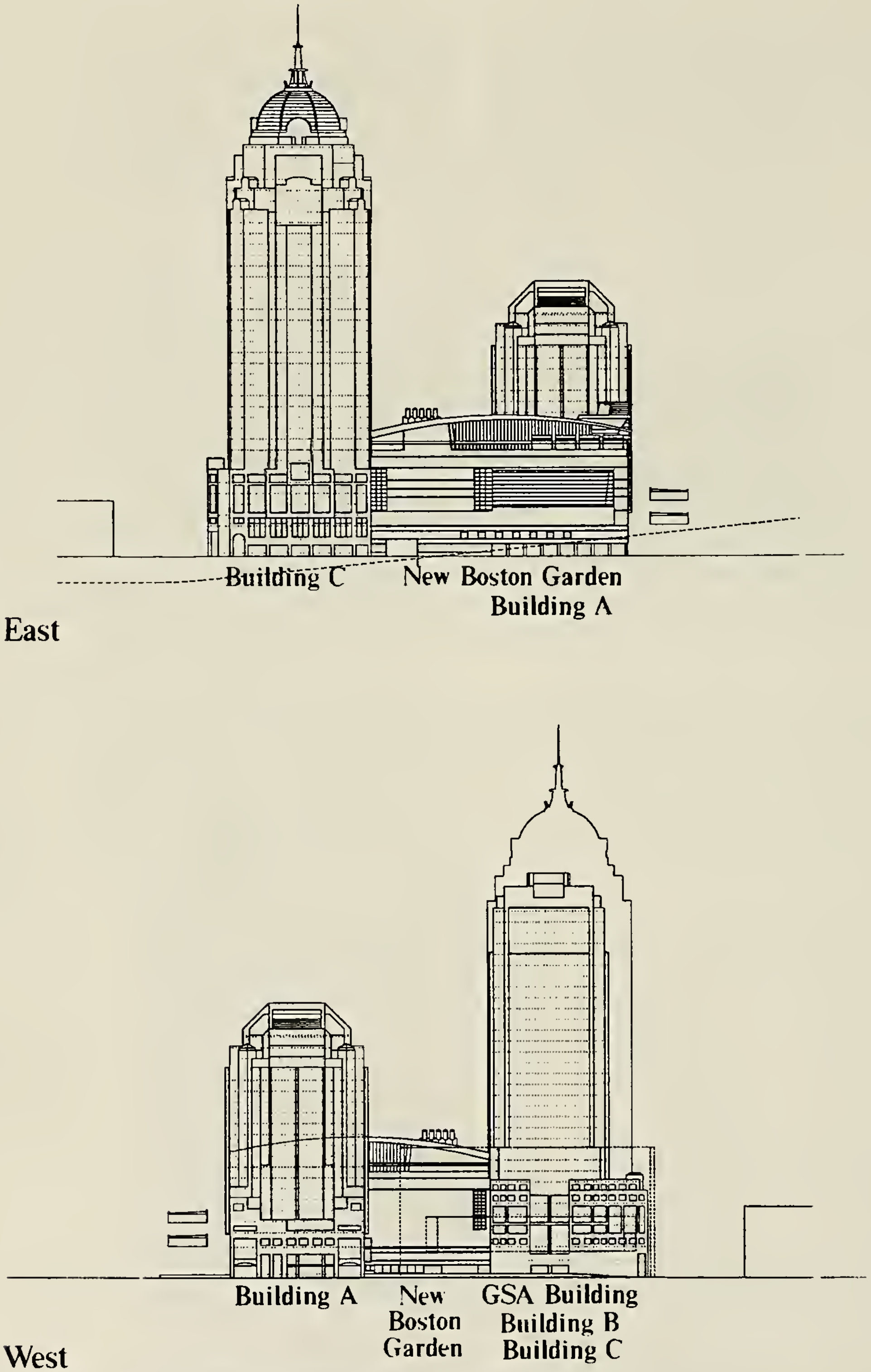


South

Source: Thomson, French & Associates

New Boston Garden Department
North and South Elevations

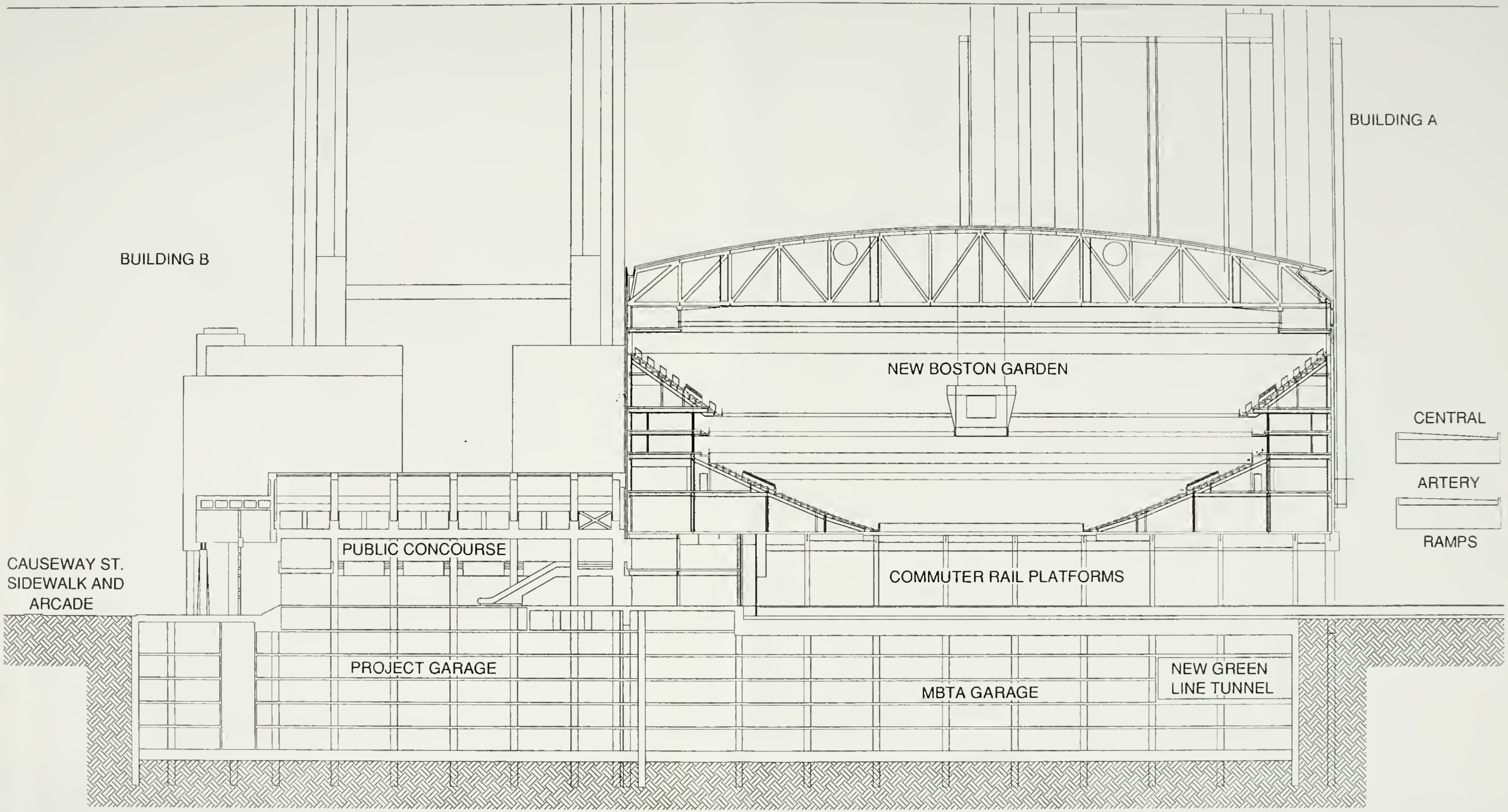
Figure II-11



Source: Thomson, French & Associates, Inc.

New Boston Garden Development
West and East Elevations

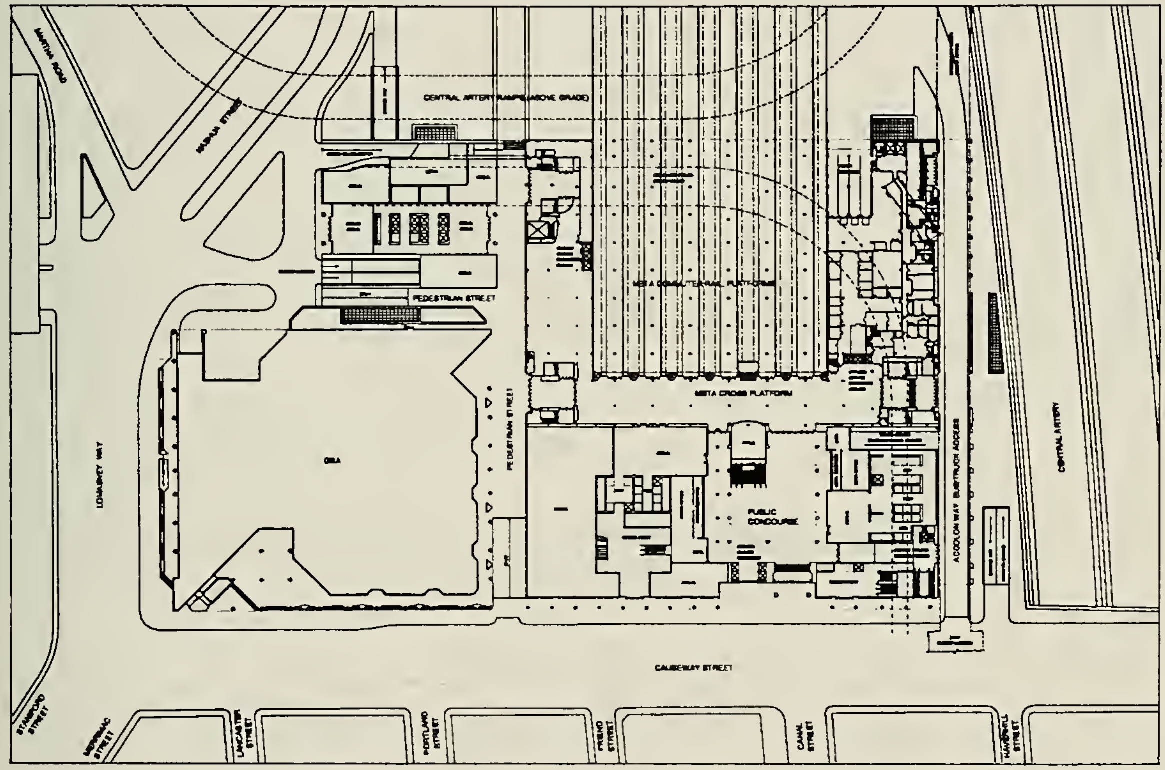
Figure II-12



Vanasse Hangen Brustlin, Inc.

Figure II-13

Enlarged Section Through Public Concourse and Arena

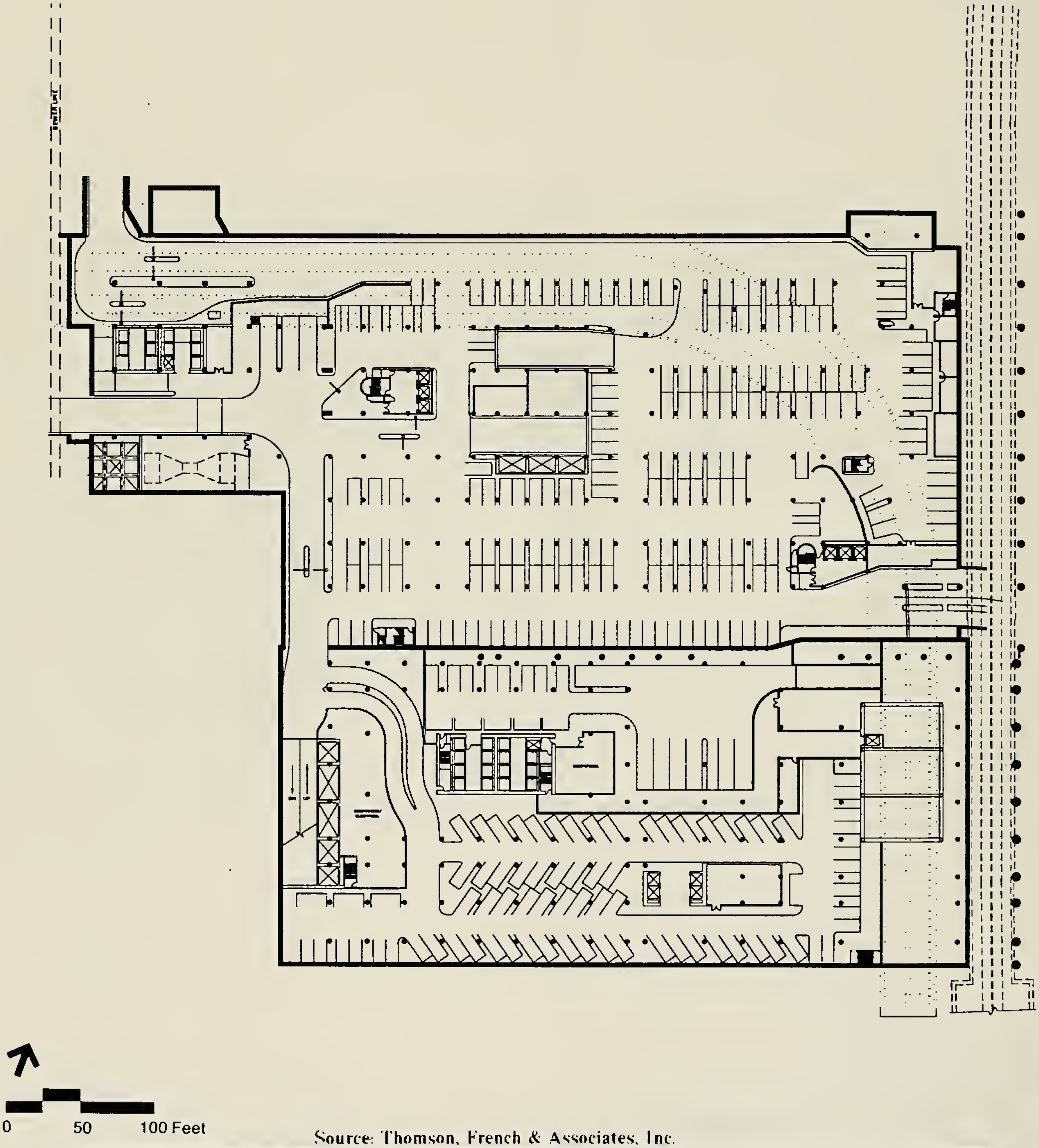


Source: Ellerbe Becket, Inc.

Vanasse Hangen Brustlin, Inc.

Project Ground Floor Plan

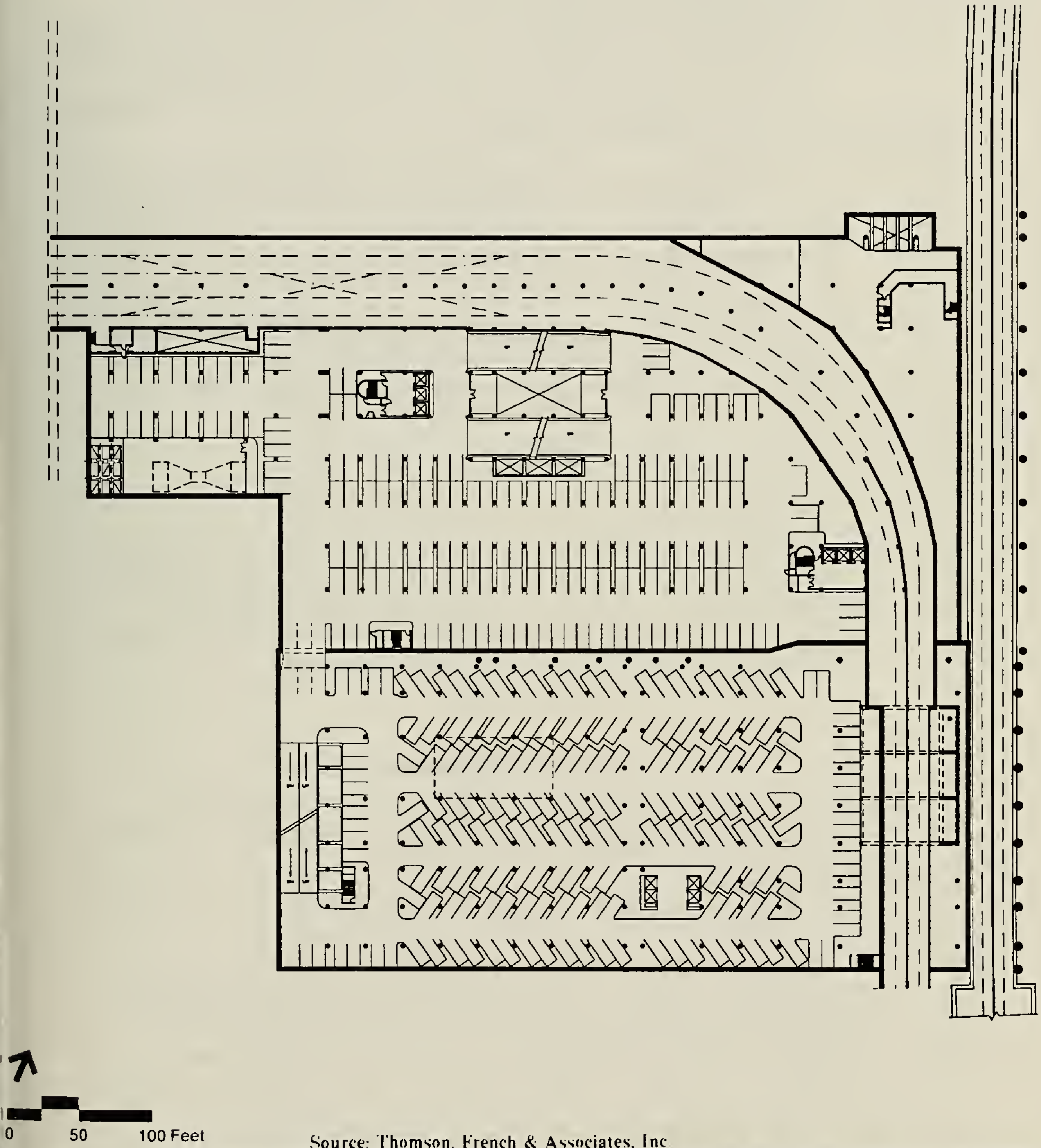
Figure II-14



Source: Thomson, French & Associates, Inc.

Parking Level One

Figure II-15



Source: Thomson, French & Associates, Inc

Vanasse Hangen Brustlin, Inc.

Parking Plan
Typical Floor Layout

Figure II-16

Certain dimensional zoning requirements have also formed the basis of the commercial component's design guidelines. Within the New Boston Garden Development Area, buildings are allowed an as-of-right height of 400 feet, while the total project is permitted an as-of-right floor-to-area ratio (FAR) of 11. The New Boston Garden Development has a proposed 10.6 FAR, and, therefore, conforms with the FAR requirements (3,071,500 square feet of total floor area x 6.67 acres x 1 acre/43,560 square feet).

The arena and Building A will comply with the zoning height requirement. The project proponent will seek appropriate zoning relief from the 400-foot restriction for Buildings B and C. As currently proposed, the arena has an approximate height of 165 feet, and the three office buildings have heights of 277 feet for Building A, 425 feet for Building B, and 475 feet for Building C (as calculated to the top of the highest occupied floor). The variation in building heights is intentional, both for design as well as market reasons which make Causeway Street the important "front door" to the site. These market influences have resulted in the planned increase in height for two of the buildings above those heights established in the MOA and the zoning.

Zoning-Specific Design Requirements

Although under Section 39-8(5) of the Code the establishment of a PDA exempts the project from the specific design requirements of Section 39-13 of the Code, the conceptual massing of the commercial elements has been provided to show that, in any case, feasible designs are compatible with the zoning design parameters. These parameters include the following, as generally summarized from Article 39 of the Code:

- Continuity of the existing street wall
- A street wall height limit of 125 feet
- Building setbacks of 40 feet in depth above the street wall base on Causeway Street (setback may be averaged for two or more buildings) and a setback depth of 35 feet on Nashua Street
- Portions of projects greater than 175 feet in height should create a visually distinctive roof or other termination of the facade

These design elements will maintain the integrity of the existing street wall defining Causeway Street. Currently, the sidewalk in front of the existing Boston Garden is approximately twelve feet wide and is covered by the arcade of the Boston Garden/North Station structure. The New Boston Garden Development will retain the arcade concept by providing a 10-foot deep covered walkway. In addition, a 15-foot wide sidewalk will be provided between the arcade and the Causeway Street curb, thereby creating a pedestrian area with a total width of 25 feet. Although the proposed arcade will be set back a greater distance from the curb than the existing arcade, the proposed column line has been located to align with the arcade of the GSA building, creating a continuous street wall along the north side of Causeway Street. The proposed street wall height assures that the base elements of the project design will relate to the scale of buildings in the adjacent Bulfinch Triangle Historic District. As shown in the existing concept plans, the street wall is approximately 100 feet high, significantly less than the 125-foot height limit. The character of Causeway Street will be further enhanced by the MBTA's scheduled removal of the elevated Green Line tracks in 1996. Above the street wall, the tower portions of the commercial component are set back from both the Nashua and Causeway streets sides in conformance with the above-referenced standards.

As shown in the conceptual design, the three building tops are all unique and distinctive. Although the arena falls below the 175-foot height limit of such a requirement, it too will have a distinctive, white roof with exposed trussing elements and battens expressive of its long-span nature.

Memoranda of Agreement Design Requirements

The planning and design of the New Boston Garden Development is guided by two Memoranda of Agreement. One is between the City, the Boston Redevelopment Authority, and the New Boston Garden Corporation, and the other is between the New Boston Garden Corporation and the MBTA. Combined, these two agreements provide for the integrated development presented in these development plans. Specifically, NBGC is allowed to develop (or sell) the rights for 2,300,000 square feet of office and retail space, parking for 1,100 vehicles, and an arena. A Public Concourse containing a minimum of 16,000 square feet also must be provided by the proponent. In addition, pedestrian access must be provided from within the project to the new MBTA rapid transit superplatform, and the realigned MBTA Green Line must be accommodated in an alignment through two levels of the NBGC garage. The MOAs represent a unique and cooperative arrangement between a private developer and various city and state agencies. Their intent is to create a mixed-use development for the North Station area--incorporating public and private facilities--that could not occur otherwise.

Coordination with MBTA Projects

The MBTA is undertaking numerous projects as part of the North Station Transportation Improvement Project to improve public transportation facilities and access. The New Boston Garden Development is integrally linked to many of these projects, requiring a high level of project coordination. Beneath the arena proper, the MBTA is constructing a parking garage, extending the commuter rail tracks and raising the platforms, and realigning the Green Line. The Garage included in the proposed project will share access and egress with the MBTA garage. Above the MBTA garage, the commuter rail tracks will be extended, and steel columns encased in concrete will be located between the tracks and platforms to support the arena. To the south of the site, a rapid transit superplatform to serve the Orange and Green Lines will be constructed, and access will be provided through the base of Building C. Operational improvements to Nashua and Causeway Streets will be implemented by the MBTA as part of its garage project, and additional future improvements to Causeway Street will be completed by the state. Further discussion of area infrastructure improvements is provided in Chapter III, Site and Area Description, and Chapter IV-J, Infrastructure.

Architectural and Master Planning Collaboration

Although the designs of the arena and commercial development will be the work of separate architects, the project proponent has retained a master planner/architect in addition to the architect for the arena. These two design teams have worked closely to define overall project goals, design parameters and dimensions, and areas of common need for the arena, the MBTA, and commercial uses. While the development will have distinct elements, each will play an important role in unifying and integrating the New Boston Garden Development.

Operational Considerations

Sequencing of the project construction is driven by the need to have a new arena in operation for the 1993 professional hockey and basketball seasons and is also driven by the needs of the MBTA garage and other public transportation improvement projects. To this end, the New Boston Garden will be constructed first on the site immediately to the north of the existing arena, above the MBTA underground garage. When the New Boston Garden has been completed, the existing arena will be demolished to allow for the commencement of the commercial construction. The project's underground garage will be constructed simultaneously with Building C and the Public Concourse using up-down construction methods, as described in Chapter IV-N, Construction. The project proponent and the MBTA are working together to maintain continuous, safe pedestrian access to commuter rail facilities throughout construction. An extensive construction mitigation package is proposed in Chapter IV-N, Construction.

Servicing of the arena and commercial development will be accomplished with off-street loading facilities. For Buildings A, B, and C, service areas will be located below grade in the first level of the parking garage. As noted above, garage access and egress will be shared between the the MBTA and project garages. A Transportation Access Plan is presented in Chapter IV A, Transportation.

PUBLIC BENEFITS

The project will provide a new, privately financed, multi-purpose sports and entertainment arena for the City of Boston. The new arena will continue to be the home of the Boston Bruins and the Boston Celtics, and is expected to host approximately 240 events in its first year, increasing to approximately 270 events annually. In addition, the project will include office and retail components which will contribute significantly to the economic expansion of Boston and to the strengthening of the City's tax base. Beyond the benefits of a new arena and commercial development, the project will generate a variety of important benefits, including taxes to the City and state, job opportunities, transportation improvements, housing contributions, public amenities, and infrastructure improvements. These benefits are detailed below.

Fiscal Benefits

Arena

The City of Boston will receive a significant increase in annual property tax revenues as a result of the new arena. These tax benefits will commence in fiscal year 1994. The City could expect to collect approximately $650,000 in property taxes (year 1994 dollars) annually from the existing arena. After completion of the new arena, the City should collect approximately $3,100,000 in property taxes (year 1994 dollars) annually from the arena. This represents an increase in property tax revenues of approximately $2.5 million per year over the amount collected from the existing arena.

Commercial Component

The City will also receive a significant increase in annual property tax revenues as a result of the commercial component of the project. The tax benefits to the City will materialize in stages as the project proceeds, starting in fiscal year 1996. Without the project, the City could expect to collect no property taxes annually from the non-arena portions of the project site. After completion of the project, the City should collect approximately $17 million in property taxes (year 2000 dollars) annually from the commercial component of the project. This represents an increase in property tax revenues of approximately $17 million per year over the amount currently collected from the non-arena portion of the site.

Transportation Benefits

Arena

Public Transportation. The new arena will be planned and carried out in coordination with the improvements to North Station commuter rail facilities and the Orange and Green Lines being conducted by the Massachusetts Bay Transportation Authority ("MBTA") and with the MBTA North Station garage project. Such coordination will help to facilitate commuter rail, rapid transit, arena patron circulation, and public safety. These arena-related benefits will contribute to the achievement of superior public transportation facilities at North Station that will serve as the major transportation gateway to Boston from the north.

Pedestrians. The new arena will result in improved pedestrian connections between the arena and the Green Line, Orange Line, and commuter rail services. In addition, the new arena will be accessible to disabled persons.

Parking. The proponent will work with the MBTA to coordinate operations of the new arena with operation of the MBTA's North Station parking facility, to ensure efficient and safe operations of that facility.

Off-Street Loading. The New Boston Garden will provide for off-street bus loading and parking, arena service access, and media vehicle operations. This will provide a substantial benefit to pedestrian safety and vehicular operations on Causeway Street.

Commercial Component

Public Transportation. The commercial component of the project will include construction of a new rail passenger waiting room and ticket area at North Station. In addition, the commercial component will provide improved connections with the MBTA's Green Line and Orange Line and the commuter rail lines and access from such facilities to the street. Such coordination will help to facilitate commuter rail and rapid transit patron circulation and public safety. The commercial component of the project will be planned and carried out in coordination with the MBTA's improvements to North Station commuter rail facilities and the Orange and Green Lines and with the MBTA North Station garage project. In particular, the commercial component will be designed to accommodate the tunnel for the relocated Green Line as planned by the MBTA. Like the new arena, the commercial component of the project will contribute to the achievement of superior public transportation facilities at North Station so that it may serve as the major transportation gateway to Boston from the north. In addition, the commercial component will be consistent with, and will contribute significantly to implementing, the state's policy of locating major employment centers near public transportation nodes.

Pedestrians. The commercial component of the project will result in improved streetscapes in the project area and improved pedestrian crossings at key intersections adjacent to the project site. These improvements will enhance pedestrian safety as well as minimize disruptions to the flow of vehicular traffic. In addition, the commercial component of the project will result in safe and convenient pedestrian connections with the Green Line, Orange Line, and commuter rail services and will not conflict with vehicular movements on the area roadways. The commercial component of the project will provide full public pedestrian access throughout the ground floor. In addition, it will create pedestrian links with neighboring areas, including Charles River Park, Massachusetts General Hospital, and the Charles River.

Parking. The commercial component of the project will include a new parking facility that will provide needed parking for arena patrons, office tenants, and short-term visitors to the area. Irrespective of ownership, the New Boston Garden Development and MBTA parking facilities have been designed to allow for a single operator to ensure efficient and safe operations of both facilities.

Off-Street Loading. All deliveries and building servicing will occur off-street at the first level of the underground project Garage. This will benefit pedestrian safety and vehicular movements on Causeway and Nashua Streets, and it will improve the visual quality of the streetscape environment.

Job Benefits

Arena

Construction Jobs. The arena portion of the project is expected to generate approximately 700 construction jobs. The proponent will work with the Mayor's Office of Jobs and Community Services (OJCS) to develop strategies for complying with the City's employment goals, and the proponent will develop a Boston Residents Employment Construction Plan (the "Plan") in accordance with the Boston Residents Jobs Policy to use best efforts to meet the Boston

Residents Employment Standards which are designed to ensure that Boston residents, minorities, and women will be employed for 50 percent, 25 percent, and 10 percent, respectively, of person-hours in construction jobs on a craft-by-craft basis. At average construction worker earnings of approximately $35,000 per year, total construction earnings generated by the arena portion of the project will be approximately $25 million.

The proponent will designate a person to be responsible for implementing the Plan. The Boston Residents Construction Employment Standards will be incorporated in the general contract, and the general contractor will be responsible for implementing the requirements of the Plan. The standards will also be incorporated in all contracts with subcontractors. The general contractor and each subcontractor will designate specific individuals to be responsible for compliance with the Plan.

The proponent intends to take a proactive posture in ensuring the effectiveness of the Plan. In addition, the person designated by the proponent for implementing the Plan will encourage the general contractor to explore relationships with organizations involved with Minority and Women-owned Business Enterprise (M/WBE) issues, such as the Massachusetts State Office of Minority and Women Business Assistance (SOM/WBA), and special efforts will be made to advertise construction and M/WBE opportunities.

Permanent Jobs. The arena portion of the project is expected to generate approximately 50 new permanent jobs. The proponent will cooperate fully with the Boston Employment Commission to encourage to the extent possible, making permanent jobs available to Boston residents, minorities, and women, and will develop a voluntary Employment Opportunity Plan detailing the proponent's good faith efforts to achieve the goal of 50 percent new, permanent, entry-level jobs created and held by Boston residents. In addition, the proponent will provide leadership in informing other employers with employees at the new arena of available employment training and referral sources. The proponent will monitor efforts to comply with the City's employment goals through regular surveys to determine how many Boston residents, minorities, and women have been hired.

Jobs Linkage Funds. Under Article 26B of the Boston Zoning Code, jobs linkage contributions of approximately $425,000 will be provided in connection with the new arena.

Commercial Component

Construction Jobs. The commercial component of the project is expected to generate approximately 2,400 construction jobs and approximately construction worker-years. In connection with the commercial component, the proponent will work with the OJCS to develop strategies for complying with the City's employment goals, and the proponent will develop a Boston Residents Employment Construction Plan (the "Plan") in accordance with the Boston Jobs Policy to ensure that Boston residents, minorities, and women will be employed for 50 percent, 25 percent, and 10 percent, respectively, of person-hours in construction jobs on a craft-by-craft basis. Total construction earnings generated by the commercial component of the project will be approximately $100 million.

The proponent will designate a person to be responsible for implementing the Plan. The Boston Residents Construction Employment Standards will be incorporated in the general contract, and the general contractor will be responsible for implementing the requirements of the Plan. The standards will also be incorporated in all contracts with subcontractors. The general contractor and each subcontractor will designate specific individuals to be responsible for compliance with the Plan.

The proponent plans to take a proactive posture to ensure the effectiveness of the Plan. In addition, the person designated by the proponent for implementing the Plan will encourage the general contractor to explore relationships with organizations involved with M/WBE issues, such as the SOM/WBA, and special efforts will be made to advertise construction and M/WBE opportunities.

***Permanent Jobs*.** Approximately 8,300 new permanent jobs are expected to be created at the site in connection with the commercial component of the project. The proponent will cooperate fully with the Boston Employment Commission to encourage, to the extent possible, making permanent jobs available to Boston residents, minorities, and women, and will develop a voluntary Employment Opportunity Plan detailing the proponent's good faith efforts to achieve the goal of 50 percent of new, permanent, entry-level jobs being held by Boston residents. Since most of the employers in the commercial component of the project will be tenants, the proponent will provide leadership in informing tenants of available employment training and referral sources. The proponent will monitor efforts to comply with the City's goals through regular surveys of the project to determine how many Boston residents, minorities, and women have been hired.

***Jobs Linkage Funds*.** Under Article 26B of the Boston Zoning Code, jobs linkage contributions of $2.2 million will be provided in connection with the commercial component of the project.

Housing Benefits

Arena

Under Article 26A of the Boston Zoning Code, housing linkage contributions in the amount of approximately $2.1 million will be provided in connection with the new arena.

Commercial Component

Under Article 26A of the Boston Zoning Code, housing linkage contributions in the amount of approximately $11 million will be provided in connection with the commercial component of the project.

Public Amenities

Arena

New State-of-the-Art Arena. The project involves the construction of a new privately funded, state-of-the-art multi-purpose arena to replace the existing deteriorating facility. The new arena will be a significant factor in re-invigorating the City's image as a leading sports and entertainment center. The new arena will continue to be the home of the National Hockey League Boston Bruins team and the National Basketball Association Boston Celtics team, and it will attract events which are now going to other cities in the region because of the existing arena's antiquated facilities. The new arena will provide a small increase in seating capacity over the existing arena, unobstructed views, full accessibility, and improved lighting, sound, and mechanical systems. The new arena is expected to host approximately 270 events each year, including family entertainment, concerts, and sports events.

Urban Design. The new arena will result in significant urban design benefits, including an improved visual environment in the project area, safe public spaces in and around the arena, and an attractive new destination point in the City. The new arena will help to create a pedestrian environment which is active throughout the day and evening and is a key element in the achievement of the North Station Urban Renewal Plan.

Commercial Component

Urban Design. The commercial component of the project will also provide significant urban design benefits. Among these benefits will be an improved visual environment in the project area, safe public spaces in and around the project, improved pedestrian crossings at intersections adjacent to the project site, and an attractive new destination point in the city. The commercial component of the project will also contribute to a pedestrian environment which is active throughout the day and evening and is a significant factor in the achievement of the North Station Urban Renewal Plan.

Daycare. The commercial component of the project will provide at least 12,000 square feet of daycare facilities, including a minimum of 4,000 square feet to be provided on-site. This represents a significant expansion of current daycare facilities available in the area.

Infrastructure Benefits

Arena

The arena will provide a new storm drainage system in the project area. As a result, a significant quantity of stormwater that presently flows to combined sewers will be discharged, after oil/grease separation and grit removal, to the Charles River. This will benefit water quality in the Charles River by reducing the frequency and volume of combined sewer overflows and by improving the quality of stormwater discharge. Additional capacity will be added to the local sewers with the removal of this stormwater inflow. The proponent's commitments to this infrastructure improvement and its long-term maintenance constitutes a significant financial benefit to state and city agencies.

The arena project has contributed to the resolution of transportation planning and roadway design issues in the project area. The proponent has conducted an extensive coordination process with city and state agencies, local landowners and business people, and other interested parties. In furtherance of this effort, the proponent has contributed planning and design services for the reconstruction of Nashua and Merrimac streets, a significant benefit.

Commercial Component

The infrastructure benefits of the commercial component build upon those of the arena project. Additional areas of the site drainage system will be reconstructed to further reduce stormwater inflow to combined sewers, a benefit to water quality in the Charles River and Boston Harbor. Concerning roadway improvements, the proponent will continue to contribute to the the planning and coordination efforts for the redesign of local area streets. In addition, the proponent will make a fair-share contribution to the reconstruction of Nashua Street as part of the development of the commercial component.

III Site and Area Description

AREA DESCRIPTION

The New Boston Garden Development site comprises approximately 6.7 total acres within the North Station area of Boston (see Figure III-1). The North Station area is adjacent to several Boston districts, including the Bulfinch Triangle, the West End, Government Center, and the North End. Each of these areas is briefly described below and is identified in Figure III-2. Additional discussion of the North Station and Bulfinch Triangle districts is provided in Chapter IV E, Historic Resources.

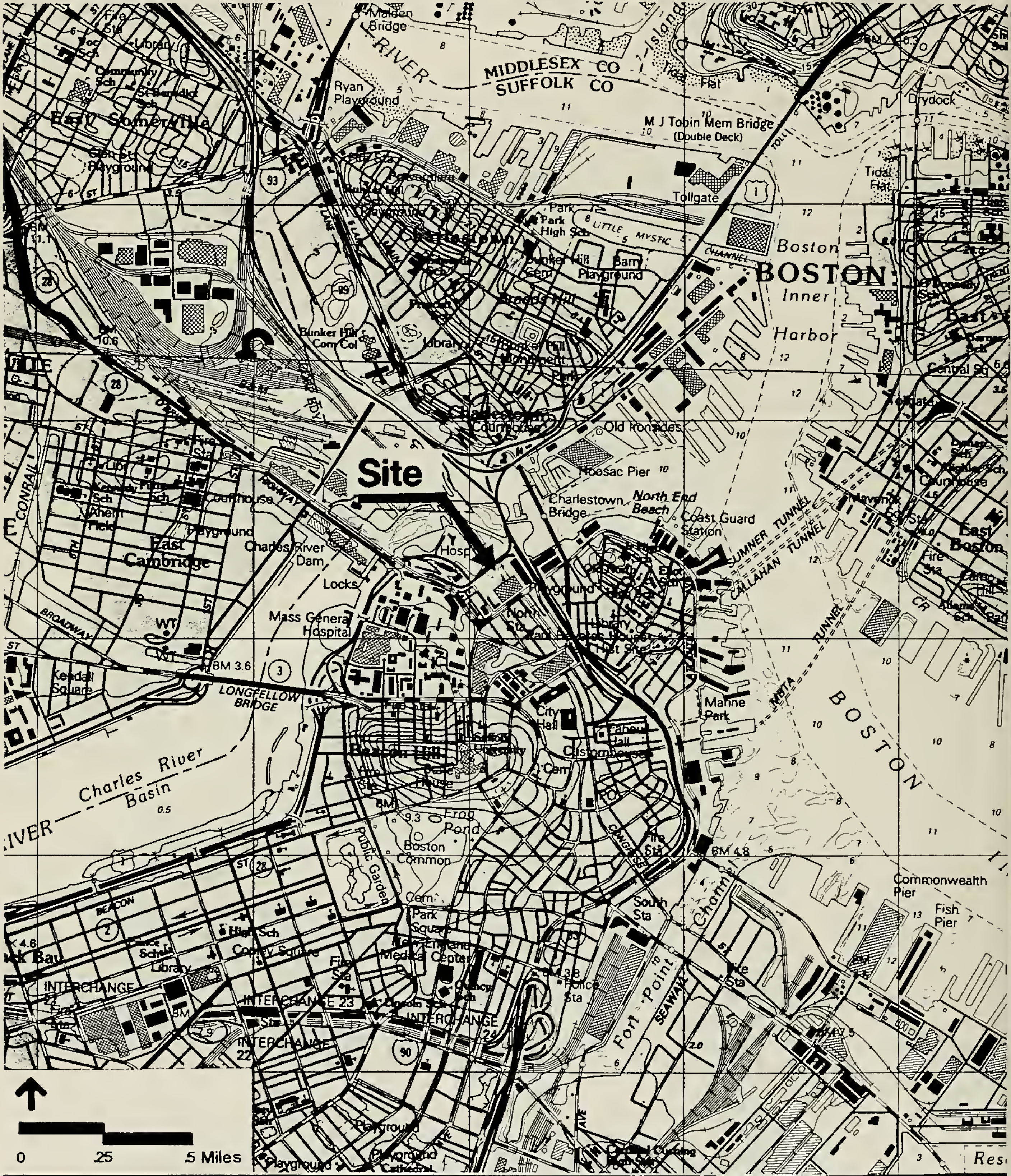
North Station Area

The North Station area is generally bounded by Causeway Street to the south, the North Washington Street Bridge (Charlestown Bridge) to the east, the Charles River to the north, and by Martha Road and Lomasney Way to the west. Like many sections of Boston, including the Bulfinch Triangle, the area once was part of the tidal flats of the Charles River basin and was created in the early 1800s with fill from the city's hills and other sources. The site of the proposed New Boston Garden Development was developed first as a commercial waterfront and, by the 1830s, as a rail terminus.

North Station derives its name from its historic relationship to the railroad industry. Four of the seven original railroads which had tracks radiating out of Boston to the north established their terminals on or near Causeway Street. In 1889 Union Station was built on the site to consolidate the various railroad facilities. At the time, it was the largest station in the United States and served approximately 500 trains a day. By the early 1920s, however, the station (which was operated by the Boston & Maine Railroad) was inadequate to serve the daily passenger load, creating the need for a new facility.

Union Station and the depots behind it were demolished in 1927 to make way for the construction of the existing Boston Garden/North Station building. The project included the development of an arena (Boston Garden) built above the new North Station terminal and was owned by the Boston & Maine Railroad.

North Station was formally opened on November 14, 1928, in a ceremony attended by President Calvin Coolidge. Train facilities occupied the ground floor and mezzanine and were designed to accommodate 80,000 passengers daily. Boston Madison Square Garden arena opened on November 17, 1928, with a



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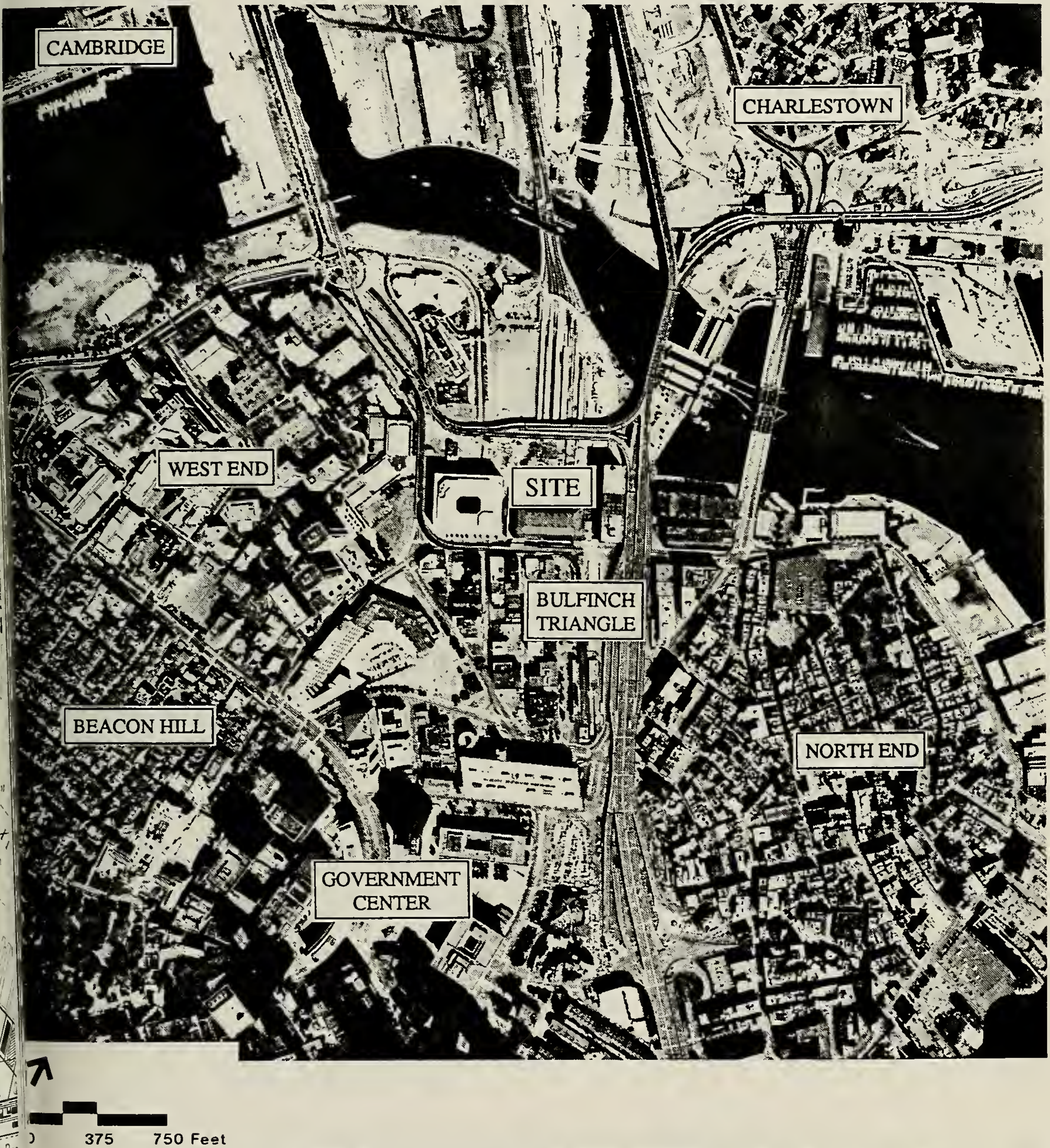
USGS Locus Map

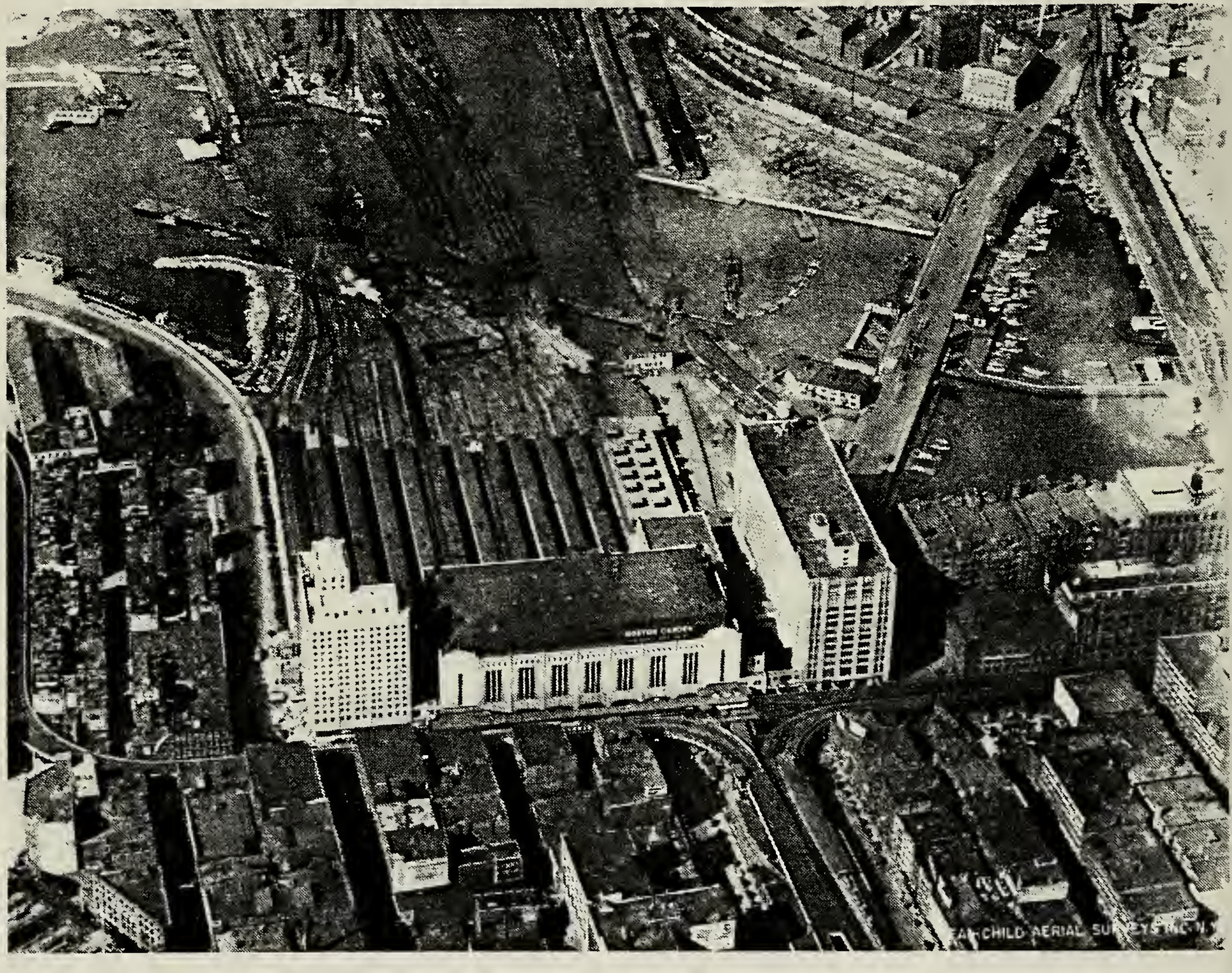
Figure III-1



Vanasse Hangen Brustlin, Inc.

Aerial Photograph of Project Area

Figure III-2



Courtesy of: Boston Public Library, Print Department

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Site Development
Circa 1930

Figure III-3

seating capacity of 14,000 to 18,000 people. It was reported to be the largest arena in the United States at the time. In 1929 a competition was held to rename the arena and since that time it has been known as Boston Garden.

Construction of Boston Garden/North Station was part of a larger development project which included the widening of Causeway Street, construction of the adjacent North Station Industrial Building (Anelex Building/150 Causeway Street) and the now demolished Hotel Manger, later known as the Hotel Madison (see Chapter IV E, Historic Resources). The Federal General Services Administration (GSA) Building, constructed in 1983, is presently located on the former hotel site. The original development project circa 1930 is shown in Figure III-3.

Today railyards continue to be a major land use within the North Station area, although activity has declined from the area's heyday in the late nineteenth and early twentieth centuries. At the time Boston Garden/North Station opened, it was served by sixteen to twenty active tracks and three bridge crossings over the Charles River. Currently ten tracks and one bridge serve North Station, and it is presently the terminus for four commuter rail lines. The North Station facilities and the commuter rail lines are owned by the Massachusetts Bay Transportation Authority (MBTA), and are operated by Amtrak. Additionally, two MBTA rapid transit lines--the Orange Line and the Green Line--have stations on the south side of Causeway Street. The Orange Line runs below-grade while the Green Line is elevated in an alignment between Canal and Haverhill streets, extending west along Causeway Street to the south of the project site. Originally these tracks also branched to the east along Causeway Street. The east branch was removed with the construction of the Fitzgerald Expressway (Central Artery) in 1954. The elevated west branch is scheduled to be removed in 1996 when the Green Line is relocated to a new below-grade alignment which passes through the site.

In addition to commuter rail and rapid transit, other dominant transportation-related uses in the North Station area include the elevated Central Artery and its ramps to Leverett Circle, the Charlestown Bridge (North Washington Street Bridge), other important city roadways, and parking lots. While land uses in the adjacent Bulfinch Triangle and North End tend to be of a modest scale, those of the North Station area, the West End, and Government Center consist of predominantly large-scale land uses. Additional North Station area uses include institutional (Spaulding Rehabilitation Hospital), government-related (Federal GSA Building, Registry of Motor Vehicles, new Suffolk County Jail, Charles River locks and dam operated by the Metropolitan District Commission), and office uses (Anelex Building).

Bulfinch Triangle

The Bulfinch Triangle is named after the architect Charles Bulfinch, who provided the triangular-shaped plan for the district and served as its principal developer. At the time of the early European settlement of Boston (after 1623), this area was known as the North Cove. Originally the North Cove left only a very narrow and swampy causeway connecting the North End to the rest of the city. At low tide, the marshy tidal flat of the cove area was passable along the line of present-day Causeway Street.

In the 1640s, millers who had been granted water rights transformed the North Cove into a large mill pond by damming the basin at its mouth (Causeway Street). As the city grew and the demand for land increased, additional land was typically created by filling in the waterfront. In 1804, the North Cove mill owners reached an agreement with the City to fill the cove, with Charles Bulfinch providing the plan for the layout of the new 50-acre area. The resulting design was triangular in shape, with the apex at Haymarket Square, the base along Causeway Street, and Merrimac and Washington Streets forming the sides.

The filling of the mill pond, begun in 1807, was accomplished through the partial levelling of nearby Beacon, Cotton (Pemberton), and Copps Hills. The completion of the landfill in the mid 1830s coincided with the establishment of the railroads, whose termini were built on the site of the existing Boston Garden/North Station. The proximity to the rail lines in the North Station area spawned travel-related uses, such as hotels, stables, and bars, within the Bulfinch Triangle. Proximity to freight rail facilities also encouraged the district's growth as a center for furniture manufacturing and sales. After the 1920s, the district gradually ceased to be a major center of the furniture trade, due in part to the transformation of North Station into a commuter, rather than freight, facility and the general decline of the furniture manufacturing business in Boston.

Today the Bulfinch Triangle is rich in well-preserved examples of commercial architectural styles which were popular from the 1870s to the 1900s. A portion of the area, encompassing 59 structures, has been designated as the Bulfinch Triangle Historic District and is listed on the National Register of Historic Places (see Chapter IV E, Historic Resources). The center of the district is composed of a series of narrow blocks of north/south streets whose buildings are predominantly five and six stories in height. The district is characterized by masonry commercial buildings of Second Empire, Romanesque Revival, and Beaux Arts styles that were popular in commercial architecture of the 1870s to 1900s. Several of Boston's leading architects of that era were responsible for the design and execution of the buildings in the district, and the structures exhibit a wide variety of ornament and detail typical of the period. Due to extensive rebuilding during the late nineteenth and early twentieth centuries, only a few three- and four-story structures in the southwest corner of the Bulfinch Triangle have survived from the earliest period of the area's development.

The construction of the elevated Fitzgerald Expressway (Central Artery) in the 1950s and the Government Center Garage in the 1960s severed the Bulfinch Triangle's eastern edge and eliminated its southern tip, separating much of the district from the North End, Government Center, and the Financial District. In recent years, many of the five- and six-story buildings within the district have been renovated, attracting smaller office and retail tenants from the nearby Financial District. In addition, several new office buildings have been constructed on "infill" parcels. A few of the Bulfinch Triangle buildings continue to be occupied by furniture-related businesses. Overall, the character of the district is being transformed to one of an active, vibrant office, retail and restaurant area.

North End

The North End, originally a peninsula centered on Hanover Street, has been settled since the earliest arrivals of Europeans in the area. For more than a century and a half it has been an ethnic enclave, first Irish, then Eastern European, and, more recently, Italian. The North End is one of the most vibrant and distinctive residential districts of the city. The apartment-style residences are tightly situated next to one another, and in fair weather it is common to see people leaning on the window sills or setting up chairs and tables on the sidewalks, creating a unique social environment. The North End also includes many restaurants, small shops, offices, churches, and other institutions. The largest structures in the district are located near the water's edge and were originally associated with maritime uses. Many now have been converted into housing. A U.S. Coast Guard station and several wharves and marinas located in the area are remnants of Boston's historic relationship to the water.

When the North Cove area was filled in the early 1800s to create the Bulfinch Triangle, the mill pond itself was not as triangular in shape as the proposed layout of the streets. Consequently, several streets were constructed parallel to and east of North Washington Street (the border between the Bulfinch Triangle and the North End), the most easterly of these being Margin Street which was at the edge of the pond. Currently, these streets contain a mix of residential and industrial buildings which have a closer relationship to the North End than to the Bulfinch Triangle.

Although the North End has several buildings of historic interest, including the home of Paul Revere and the Old North Church, it is best known for its streets. These streets are used as "public rooms" for day-to-day activities and the many annual festivals honoring various saints. On these occasions, the streets are filled with people and booths, and are illuminated above with festive lights and decorations.

West End

Today's West End section of Boston is largely the product of urban renewal efforts of the 1960s which replaced the densely-knit commercial and residential fabric of the area with high-rise residential and commercial structures and open spaces. The West End is generally bounded by Cambridge, Staniford, and Nashua streets and the Charles River. Originally the area comprised the gardens of large houses bordering Bowdoin Square and Cambridge Street. By the end of the nineteenth century, this area was filled with tenements which created a dense street and block pattern. The West End was inhabited by immigrant workers of many nationalities. Over time, the West End neighborhood came to be seen as an area that was overcrowded, and had unsatisfactory living and sanitary conditions. The urban renewal efforts of the 1960s involved extensive relocations of individuals and communities from this neighborhood.

Today the West End is characterized by the presence of two large and distinct complexes--Charles River Park and Massachusetts General Hospital (MGH). Charles River Park consists of large buildings and towers (up to 400 feet in height) surrounded by major landscaped areas with connecting pedestrian pathways. These structures provide apartments, condominiums, commercial office and retail space, and parking.

Massachusetts General Hospital is both a major medical facility and a Harvard University teaching hospital serving the city and region. The MGH complex is a city in itself, with a series of interconnected buildings which vary widely in age and design. The Bulfinch Pavilion building dates back to 1821 and was designed by Charles Bulfinch. More recent MGH additions include a medical office building fronting Cambridge Street and a glass tower in the center of the complex. A second tower is proposed for development nearby.

Additional landmarks in the West End include institutional and recreational uses. Adjacent to MGH is the Charles Street Jail, constructed in 1851. Bordering the west edge of the West End is the Charles River Esplanade, part of a riverfront park system maintained by the Metropolitan District Commission.

Government Center

The Government Center section of Boston, like the West End, has undergone dramatic changes in character and use as a result of urban renewal efforts in the 1960s. The area was formerly known as Scollay Square and contained a mix of shops, stores, offices, and theaters. The buildings of Scollay Square formed a focus of city life, with "fanciful" subway entrance designs lending a carnival air to the area. Prior to the urban renewal efforts, Scollay Square was viewed by some city officials as a run-down and often unsavory part of Boston.

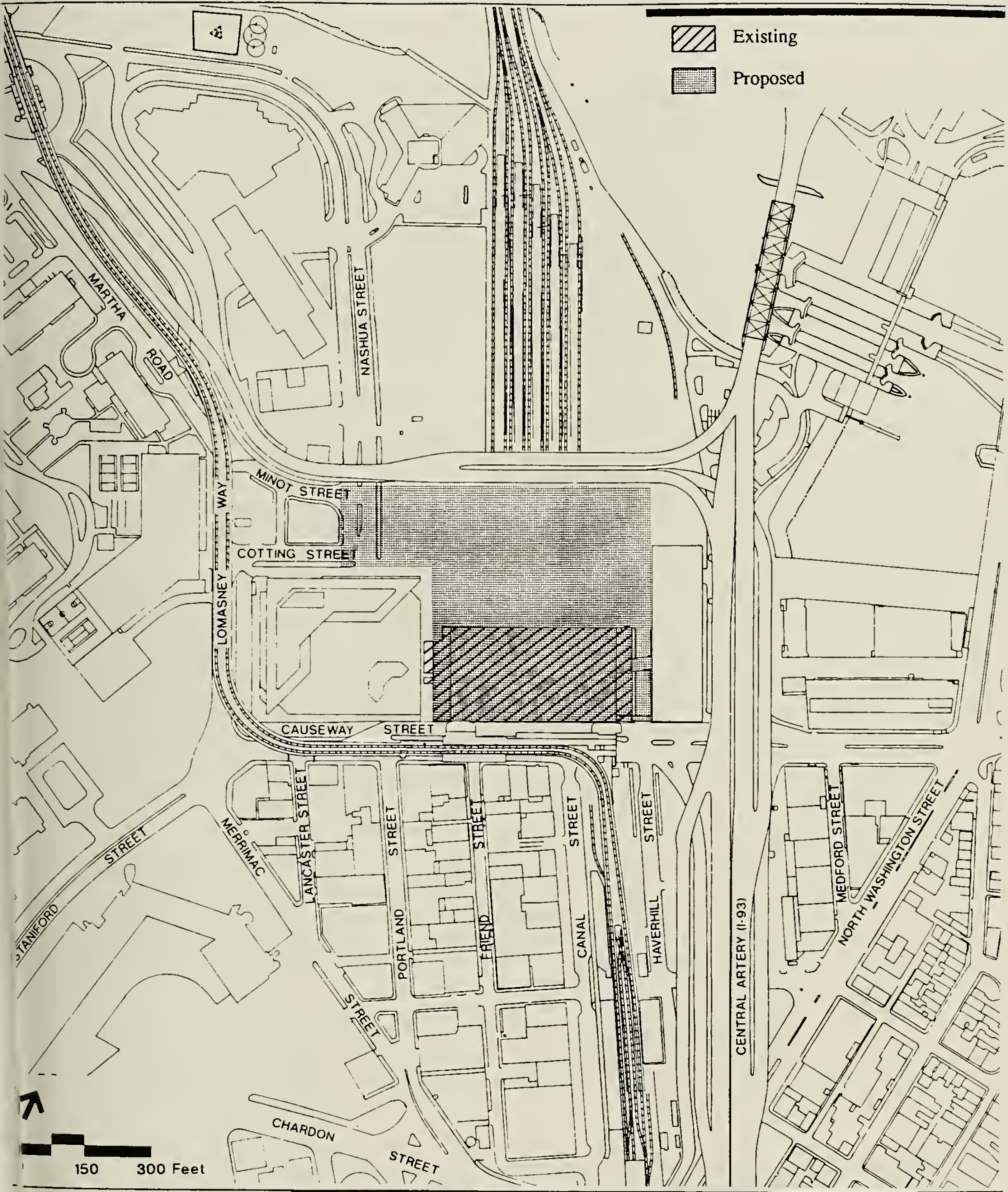
At the core of present-day Government Center is Boston City Hall, designed by the firm of Kallman, McKinnell, and Knowles in 1968. The dramatic concrete design was the winner of a national competition. City Hall is surrounded by City Hall Plaza, whose urban design plans were prepared by I.M. Pei in 1964 for the Boston Redevelopment Authority. These plans determined the plaza's size and scope, views into and from it, and the basic sizes of buildings that abut it. The plaza itself is a vast sloping brick surface, broken occasionally by steps and terracing to meet the edges of the surrounding buildings and streets.

Large-scale modern buildings within and surrounding the open brick plaza include Boston City Hall, the John F. Kennedy Federal Building, the Bank of New England Building, and Center Plaza. Separating Government Center from the Bulfinch Triangle is the Government Center Garage, which spans Congress Street. Recently, two floors of office space were added on top of the garage and a new entrance was constructed on Congress Street. To the northwest of the garage lies the Lindemann Mental Health Center, also known as the Charles F. Hurley Building or the State Service Center, a state facility occupying a large city block. In recent years this property has been the subject of discussion for potential reuse. Although it was part of the original concept plans for Government Center, some consider this building to be part of the West End, due to its location and its potential reuse as a site for housing.

DESCRIPTION OF THE SITE

Existing Boston Garden/North Station Site

The existing Boston Garden/North Station occupies approximately two acres in the North Station area of downtown Boston (see Figure III-4). The site is bounded by Causeway Street to the south, Accolon Way to the east, a parcel of



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Project Site Plan

Figure III-4

land owned by the Massachusetts Bay Transportation Authority to the north, and a public way adjacent to the Federal General Services Administration (GSA) Building to the west.

The Boston Garden/North Station building was constructed in 1928 to replace the outdated and inefficient railroad facilities of Union Station, which had occupied the site since 1889. The concept of building an arena in air rights over the railway lines is attributed to Tex Rickard, the New York boxing promoter and developer of New York's Madison Square Garden. Both the arena and the railroad facilities were owned by the Boston & Maine Railroad, although Mr. Rickard, and later the Boston Madison Square Garden Corporation, were responsible for promoting arena events.

The building was constructed at the height of a city-wide building boom and was designed in an Art Deco style. The exterior is buff-colored brick and false blue glass windows arranged in strong vertical patterns. Two spires on either end serve to distinguish the building. The building is considered by the Massachusetts Historical Commission to be ineligible for inclusion in the National Register of Historic Places or for protection as an historic resource on the State Register of Historic Places.

The Boston Garden/North Station building was constructed as part of a larger development which included the Hotel Manger (later renamed the Madison, occupying the site of the existing GSA Building) and the North Station Industrial Building, currently known as the Anelex Building or 150 Causeway Street. The Anelex Building lies to the east of Accolon Way and contains approximately 549,000 square feet of office space. It provides storage and management offices for the existing arena and is connected by two bridges above-grade to the arena floor of Boston Garden. As part of the reconstruction of the Central Artery, the Anelex Building is scheduled to be demolished by the Massachusetts Department of Public Works (MDPW) in 1992.

Train ticketing facilities, a passenger waiting room with limited seating, and various shops currently occupy the ground floor of Boston Garden/North Station. In order to access the trains from this area, passengers must walk outdoors under a covered walkway to the train platforms at the north end of the MBTA parcel. Connections from commuter rail to the MBTA rapid transit service are poor and can be made only by walking through North Station and crossing to the south side of Causeway Street.

Boston Garden is located above the train facilities and is home to the Boston Bruins National Hockey League team and the Boston Celtics National Basketball Association team. Seating capacities are 14,422 and 14,890 for hockey and basketball games, respectively. Boston Garden also plays host to concerts, rallies, circuses, ice shows, and religious meetings, totaling approximately 210 events annually. Over the years, Boston Garden has come to be known for its character, its atmosphere, and its traditions. The Boston Garden is an exciting place to see a live sporting event, despite the lack of modern amenities. The age of its design and construction is reflected by the large number of obstructed view seats in the arena.

Despite extensive work on the Boston Garden which has been performed to improve the condition of the building, it is in need of considerable renovation and improvement, particularly in relation to the building's systems. The mechanical, electrical, plumbing, heating, and ventilation systems are in need of continuous maintenance, and replacement of these various systems with modern equipment is infeasible due to space and structural limitations. Additional detriments to the functioning of the arena include obstructed views, lack of an air conditioning system, and antiquated service facilities. All of these factors make it difficult for Boston Garden to compete with more modern arenas in the region, such as the Worcester Centrum and the Providence Civic Center. The train facilities, too, have become inadequate to service the increasing commuter rail passenger loads, with poor connections between the platforms, the station, and rapid transit service, while the building's exterior facade is severely deteriorated and requires ongoing maintenance to protect public safety.

Proposed New Boston Garden Development Site

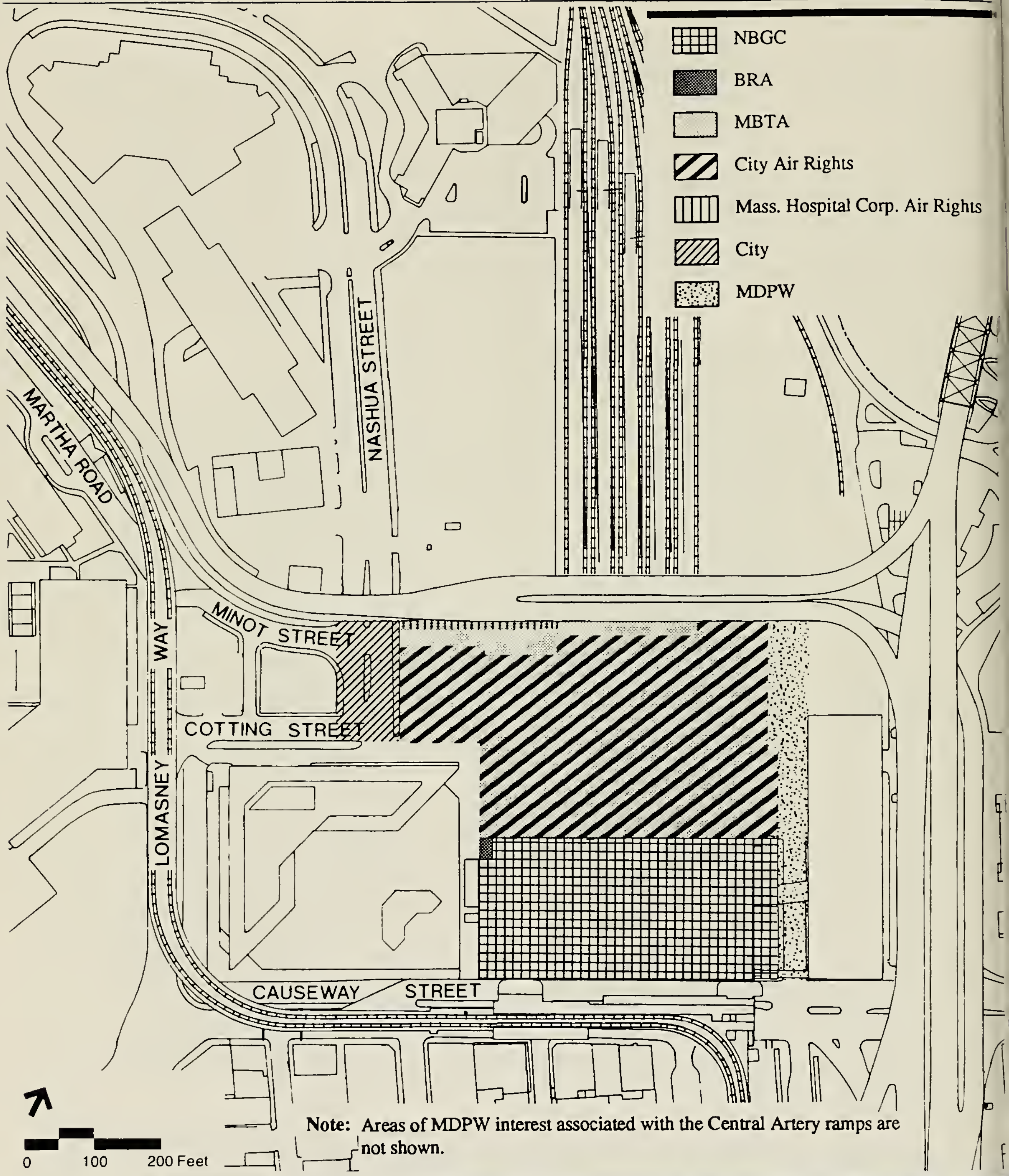
The proposed project site totals approximately 6.7 acres in the North Station area of Boston (see Figure III-4, shown previously). The New Boston Garden Development site will be bounded by Causeway Street to the south, the future mainline of the reconstructed Central Artery (I-93) to the east, the Central Artery ramps connecting to Leverett Circle and Storrow Drive to the north, and Nashua Street and a pedestrian way adjacent to the GSA Building to the west. The existing Boston Garden/North Station is the only major existing structure on the proposed site. Other areas are occupied by roadways, parking areas, are vacant, or are under construction. The current ownership interests of the project site are shown in Figure III-5 and include the following areas:

- The existing Boston Garden site along Causeway Street (2.0 acres, owned by New Boston Garden Corporation). Current uses include the North Station commuter rail terminal facilities and the Boston Garden arena.

- The air rights over land owned by the Massachusetts Bay Transportation Authority (MBTA) located immediately behind (north of) the existing Boston Garden. The air rights are owned by the City of Boston and the MBTA. A small portion of the air rights have been retained by the Massachusetts Hospital Corporation. This land was formerly used for surface parking by the general public. Currently this site is under construction and when completed in 1993, will contain an MBTA underground parking garage for 1,300 vehicles, a tunnel for the realigned rapid transit Green Line, and foundation elements to support the New Boston Garden. Additionally, the commuter rail tracks will be extended and the platforms will be raised to meet the rear facade of the existing Boston Garden. The New Boston Garden arena will be located approximately 35 feet above grade, while ancillary uses (administrative offices, storage, and service areas) will be located on the ground floor and second level between grade and the arena floor level, adjacent to the train shed.

- Air rights over or other interests in a portion of the existing Nashua Street to be acquired from the City of Boston. This parcel is within the right-of-way of Nashua Street, which will be realigned as part of the MBTA underground garage project.

- Easements to be granted by the Boston Redevelopment Authority in a parcel of land located between the existing Boston Garden and the GSA Building.



Note: Areas of MDPW interest associated with the Central Artery ramps are not shown.

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Property Interests in the Project Site Figure III-5

- Various fee interests, easements, and consents from the Massachusetts Department of Public Works (MDPW), including: the fee interest in Accolon Way from Causeway Street to the Central Artery Ramps; easements in MDPW land located along the north edges of the project site; and consents to air rights and easements to be granted by the MBTA and the City of Boston along the north edges of the project site and extending into Nashua Street, to the extent these overlap with the Central Artery easements held by the MDPW.

In addition to the parcels noted above which the development footprint will occupy, there are various easements in MDPW, MBTA, and BRA parcels which will need to be acquired for construction, maintenance, utilities, roof overhang areas, garage and building areas, bus turnaround and parking areas, and media truck hook-up areas. A more detailed description of these parcels and easements is provided in the Project Data appendix.

FUTURE DEVELOPMENT IN THE PROJECT AREA

For the purposes of evaluating No-Build and Build conditions, the effects of projects proposed to be completed by others in 1995 and 2000 have been considered. These include both public works and private development projects. The public works projects include:

- Construction by the MBTA of a 1,300-space underground parking garage on a site immediately behind (north of) the existing Boston Garden/North Station building. As part of this project, roadway improvements will be made to Nashua and Causeway Streets.

- Extension of the MBTA commuter rail tracks (275 feet) to meet the rear face of the existing Boston Garden/North Station, and raising of the platforms (4 feet), making platforms and trains fully accessible to all passengers.

- Relocation of the MBTA rapid transit Green Line to a below-grade alignment running through the project site and the MBTA underground garage. As part of this project, the existing elevated Green Line over Causeway Street will be removed.

- Construction of a new "superplatform" to facilitate transfers between the MBTA rapid transit Orange and Green Lines, and commuter rail. The superplatform will be located southeast of the site, beneath Causeway Street.

- Reconstruction of Merrimac Street to create a new arterial roadway providing access from downtown to the regional highway system.

- Reconstruction of the Central Artery. The Anelex Building (owned by the MDPW) to the east of Boston Garden will be demolished to make way for the new alignment.

- Reconstruction of City Square in Charlestown as part of the Central Artery North Area (CANA) project. This project is designed to improve traffic operations between I-93 and Route 1 and to enhance the at-grade environment of City Square.

An extensive amount of private development has been proposed for the cities of Boston and Cambridge. Discussions have been held with the Boston Redevelopment Authority, representatives of the City of Cambridge, and area developers and property owners. Due to current and projected market conditions, uncertainty regarding the feasibility and timing of these projects has been expressed by the various people consulted.

Within the immediate vicinity of the New Boston Garden Development site, three specific projects have been identified:

- An office and biotechnology center to be developed by Massachusetts General Hospital on a site on Nashua Street north of the Central Artery ramps to Leverett Circle

- Portland Place Phase II office building, to be located on the corner of Causeway and Lancaster streets in the Bulfinch Triangle

- Lowell Square housing development on the corner of Staniford Street and Lomasney Way

The effects of these developments have been considered in the various analyses of the New Boston Garden Development's environmental effects, including transportation, air quality, wind, and shadow, among others.

CONCLUSION

The New Boston Garden Development site has a long history of transportation use. In the 1920s, the construction of Boston Garden identified the site as an important place for sporting events and other public gatherings. The area surrounding Boston Garden has undergone substantial evolution in land uses, socio-economic conditions, urban design, and architecture. Much of this evolutionary process is visible in the landscape today, and is expressed in the diversity of building, businesses, and communities in the area. The construction of the New Boston Garden Development will significantly contribute to the strengthening of the area's character and identity.

IV Environmental Issues

INTRODUCTION

This chapter presents the environmental analyses and findings for the New Boston Garden Development. It addresses the Massachusetts Environmental Policy Act (MEPA) Unit Certificate (September 8, 1989) in response to the New Boston Garden Development Environmental Notification Form (ENF) and the Boston Redevelopment Authority (BRA) Scoping Determination (August 18, 1989, as modified) in response to the Project Notification Form (PNF). Pertinent comments from public agencies and other interested parties on the ENF and PNF have also been addressed in the conduct of the analyses.

Specifically, fourteen categories of environmental issues are addressed:

- Transportation
- Air Quality
- Noise
- Visual Quality
- Historic Resources
- Tidelands and Public Purpose
- Wind
- Shadow
- Daylighting
- Infrastructure
- Water Quality
- Solid and Hazardous Wastes
- Geotechnical Conditions
- Construction

A Transportation Access Plan

INTRODUCTION

This analysis focuses on the transportation issues related to the New Boston Garden Development. Transportation is an important concern because the project is located in an area containing major highway, commuter rail, and rapid transit facilities, all of which are planned to have major improvements within the next decade. This chapter presents the results of an exhaustive transportation analysis, which examined the following:

- The current use of existing roadways, public transportation, parking facilities, and pedestrian paths serving the site and the surrounding area
- Existing state and city plans to improve area transportation facilities, including reconstruction of the Central Artery (I-93), relocation of the MBTA Green Line, and construction of the MBTA underground garage at North Station
- Changes in demands on area transportation facilities from other planned development in the North Station area and from growth outside the area
- Impacts of the New Boston Garden Development on the transportation system in 1995 (Interim-Build conditions), 2000 (Full-Build conditions), and during construction
- Impacts of the arena component of the project on the 1995 transportation system (Arena-Only conditions)
- Proposed mitigation strategies to address project impacts

Analyses were performed for existing and future conditions to project the impact of development in terms of vehicle, transit, and pedestrian trips to and from the project site. Analyses of parking supply and demand for future forecast years and conditions were conducted. Other proposed developments in the study area as well as projected regional growth have been included in the assessment of future year conditions. The analysis presented in this chapter is based on the Boston Redevelopment Authority (BRA) scope dated August 18, 1989, as modified, and on the Massachusetts Environmental Policy Act (MEPA) Unit scope dated September 8, 1989 (see Chapter VII). Data and analyses used to support this report are presented in the Technical Data appendix.

The results of this analysis indicate that the site is well located with respect to existing highway and transit facilities, and access will be greatly improved in the future because of several planned transportation improvements. The project itself will provide substantial enhancements to the pedestrian environment. Project-generated traffic will be minimized by extensive use of transit as is currently in evidence in the area and by the proponent's proposed efforts to support transit use and encourage greater ridesharing. The Central Artery North Area (CANA) project and the planned reconstruction of the Central Artery through downtown will provide improved connections to the regional highway system, thereby limiting project traffic impacts on downtown intersections. Improvements at Leverett Circle will provide a direct connection to I-93 and Route 1 from the site, and greater capacity to accommodate traffic between Storrow Drive and the North Station area. A new Surface Artery serving the North Station area will provide good connections to I-93 north and south from the project's Causeway Street garage entrance, and a redesigned City Square will provide a higher capacity connection to I-93 (north and south) and to Route 1 via the Tobin Bridge.

Transit and pedestrian facilities will also see significant improvements and will have the capacity to accommodate project demands. New commuter rail platforms and a direct connection to the new MBTA Orange Line and Green Line superplatform will be provided on site. A greatly improved pedestrian environment will be established as a result of the Public Concourse to be provided within the project, a widened sidewalk along Causeway Street, and the removal of the overhead Green Line along Causeway Street and Lomasney Way. The project will also provide greatly improved loading facilities for the arena.

The analysis showed that impacts of the arena replacement on the area transportation system are small. This is because arena events generally occur outside the peak hours of travel and because the proposed arena is not much larger than the existing Boston Garden.

New Boston Garden Development Proposal

The New Boston Garden Development proposal includes four major elements: a new 755,500 square foot sports and entertainment arena with a maximum seating capacity of 19,500; a 16,000 square foot Public Concourse; a commercial component consisting of 2,250,000 square feet of first class office space and 50,000 square feet of retail space; and an 1,100 space garage. The office space will be distributed among three separate buildings. The proposed program is summarized in Table IV-A-1.

The new arena will be a state-of-the-art, multi-purpose facility, which will accommodate sports events, concerts, and family shows such as circuses and ice shows. For purposes of projecting transportation impacts of the new arena, a sold-out basketball game on a weekday evening was used as the analysis event. This event was chosen because it represents the largest team sports event. Team sports events occur on many weekdays--more than sixty weekdays during the 1989-1990 season. By contrast, events with greater seating capacity than the event analyzed occurred on only a few weekdays. Not all of those events, moreover, were sold out. Infrequent events do not represent a reasonable analysis condition.

Table IV-A-1

PROPOSED BUILD PROGRAM

Use	1995 Interim-Build	2000 Full-Build
Office SF*	956,000	2,250,000
Retail SF	11,000	50,000
Total Commercial SF	967,000	2,300,000
Public Concourse SF	16,000	16,000
Arena SF	755,500**	755,500
Parking Spaces	1,100	1,100

* Square feet.
** 19,500 seats maximum capacity.

Table IV-A-2 presents changes in the seating capacity for a basketball game (the analyzed event) that will result from construction of the new arena. Seating is divided between general seats and skybox seats in the existing arena and will be divided between general and premium seats (executive suites and club seats) in the new arena. Almost 3,500 additional seats will be available for basketball as a result of the new arena. The arena will be fully operational in the fall of 1993 and is included in the 1995 Interim-Build analysis and the 2000 Full-Build analysis. An analysis of arena only inpacts under 1995 conditions is also presented.

Table IV-A-2

PROPOSED ARENA SEATING CAPACITY FOR BASKETBALL

	Premium*	General	Total
Future	3,492	14,871	18,363
Existing	440	14,450	14,890
Increase	3,052	421	3,473

* Skybox seats for existing arena.

The Public Concourse will be a major new pedestrian area connecting the new North Station commuter rail facilities with Causeway Street. It is designed to support and enhance the existing and proposed uses on the site. It will provide an area for commuter rail and arena ticketing, and will connect the commercial component, commuter rail, rapid transit, and the arena with each other and with other off-site activities. The Public Concourse will be completed in the 1995 Interim-Build year.

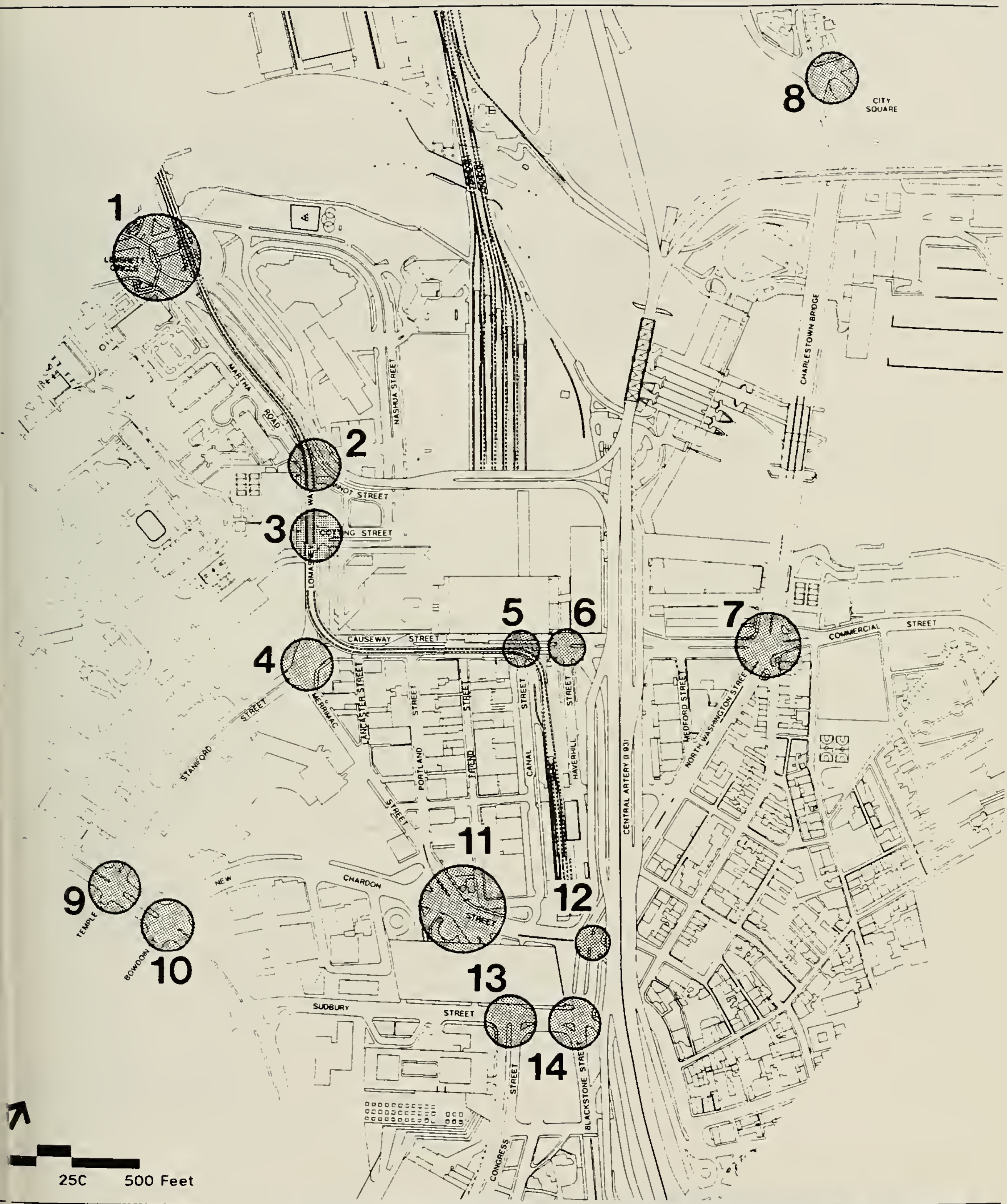
Two office buildings (Buildings B and C) and the retail space in the commercial component will be located along Causeway Street, while the remaining office building (Building A) will be located on Nashua Street. The easternmost office building on Causeway Street (Building C) and some of the retail space will be constructed by the Interim-Build year, and the remaining office and retail space will be completed by 2000, the Full-Build year.

The proposed development will also include an 1,100-space garage. It will be connected to the 1,300-space MBTA garage currently under construction. The two garages will be operated and managed as a single facility.

Study Area

The transportation study area for the proposed New Boston Garden Development primarily covers the North Station and Bulfinch Triangle areas, but also extends to Charlestown and Government Center. The study area is bounded by City Square and Leverett Circle to the north; Cambridge Street on the west; Sudbury Street to the south; and North Washington Street on the east. Fourteen intersections within the transportation study area were analyzed as required by MEPA and the BRA. The analysis locations are illustrated in Figure IV-A-1 and include the following:

1. Leverett Circle
2. Martha Road and Minot Street
3. Lomasney Way and Cotting Street
4. Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street (Lowell Square)
5. Causeway Street and Canal Street
6. Causeway Street, Accolon Way, and Haverhill Street
7. Causeway Street, North Washington Street, and Commercial Street (Keany Square)
8. City Square
9. Cambridge Street, Staniford Street, and Temple Street
10. Cambridge Street, New Chardon Street, and Bowdoin Street
11. New Chardon Street and Merrimac Street
12. New Chardon Street and North Washington Street
13. Sudbury Street, Merrimac Street, and Congress Street
14. Sudbury Street, North Washington Street, and Blackstone Street



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Existing Traffic Analysis Locations

Figure IV-A-1

The intersection of Martha Road and Minot Street and the intersection of Lomasney Way and Cotting Street will be replaced by a single intersection for future conditions referred to as Nashua Street, Martha Road, and Lomasney Way.

Public transportation facilities within the study area are extensive. Two rapid transit lines, the Orange Line and the Green Line, are located adjacent to the site. Four commuter rail lines operate out of North Station, which is located on the site. Express bus service is available at Haymarket Square, which is within walking distance of the site or one rapid transit stop away.

Study Methodology

The transportation analysis involved a comprehensive study of several components of the transportation system. It was conducted in three distinct phases: 1) a detailed inventory of existing conditions, 2) an analysis of probable project impacts, and 3) a proposal for an extensive list of measures to mitigate project impacts. The evaluation also considered the unique transportation demands of the proposed arena. As noted earlier, the analysis of arena impacts focused on a weekday evening basketball game as a typical arena event.

Phases of the Analysis

The first of the three phases of the study involved an inventory of existing conditions and travel demand characteristics in the area for several elements of the transportation system. This data collection effort included surveys of patrons of the existing arena and tenants of nearby office buildings, traffic and pedestrian counts, observations of public transportation capacity and ridership, roadway geometry inventories, traffic signal timing, and accident research.

The second phase of the study built upon the data base assembled in the first stage and established the framework for evaluating the transportation impacts of the proposed project. In this phase, specific travel demand forecasts for the project (including impacts of the arena only) were assessed along with future demands expected to be created by other area developments. Demand projections were made for all travel modes--vehicular, transit, and pedestrian--and for parking. Planned transportation improvements were included in the assessment of the capacity of the transportation system to accommodate future demands. Impacts of project construction activities on transportation facilities were also analyzed. The year 2000 was selected as the analysis year based on the anticipated occupancy of the full project. A 1995 Interim-Build condition, which includes the new arena, Public Concourse, and one office building (Building C) with its retail space, was also assessed.

The final study phase evaluated the impacts of the project on the transportation system and identified measures to mitigate impacts. Mitigation efforts included measures to enhance the effectiveness of various components of the transportation system and to reduce vehicular travel demand by encouraging shifts from single-occupant vehicles to ridesharing and transit use. The list of travel demand reduction measures is among the most extensive ever proposed in the City of Boston. Also included in this phase were the establishment of goals for vehicular travel demand reduction, and identification of a program to monitor future project travel demands and to measure the effectiveness of various mitigation measures.

Analysis Conditions

Four different conditions or time periods were considered in analyzing arena and commercial component transportation impacts. These periods include: morning commuter peak, evening commuter peak with no arena event, evening commuter peak with an arena event, and pre-event evening peak.

Morning Commuter Peak. The weekday morning commuter peak period is the typical morning period used for data collection and analysis in most transportation impact studies. The period usually covers 7:00 to 9:00 AM for traffic and 7:30 to 9:30 AM for pedestrians. Because arena events are primarily scheduled for the evening, there are no arena impacts on the morning commuter peak.

Evening Commuter Peak with No Arena Event. The weekday evening commuter peak period is also a typical analysis period in transportation studies. It generally covers the period between 4:00 and 6:00 PM and represents typical conditions on an average weekday. In downtown Boston, transportation impacts are usually greater in the evening than in the morning.

Evening Commuter Peak with an Arena Event. Because of the frequency of Boston Garden evening events and typical starting times of 7:35 PM, it could be expected that transportation demands in the evening commuter peak period might be greater on an evening with an arena event than on an evening with no arena event. As a result, traffic, pedestrian, transit, and parking counts were taken both on evenings with arena events and on evenings without arena events. In general, transportation demands were greater in the commuter peak period on evenings with arena events. Because arena events occur frequently on evenings during the fall, winter and spring months, it was decided that the event night evening peak hour should be the analysis condition for evaluating evening commuter peak hour impacts.

Pre-event Peak. An additional consideration with regard to arena impacts was whether total travel demands on event nights are greater in the commuter peak hour or in another hour prior to the event. Traffic, pedestrian, and transit counts were conducted for a 4-hour period from 4:00 to 8:00 PM on event nights to determine the actual peak hour. In most cases, the greatest demand on the system occurred during the commuter peak hour. As a result, the commuter peak hour was generally used as the evening analysis condition. In selected cases where arena impacts might make the pre-event peak the period of highest total demand, a pre-event analysis was conducted.

EXISTING CONDITIONS

Traffic

The following inventory of roadway characteristics, intersection geometry and operating conditions, traffic volumes, and levels of service was compiled as part of the Phase I data collection process.

Roadway Network

Roads are classified according to their function. Limited-access highways are intended to serve only long trips, arterials serve a mix of through and local trips, local streets are intended to serve only their abutting properties, and connectors (sometimes called collector/distributors) link local streets to arterials or to limited-access highways. Table IV-A-3 describes the main roads within the study area.

Major external roadways providing access to the study area include:

- The Massachusetts Turnpike (I-90) from the west by way of the Central Artery
- Storrow Drive from the west
- The Tobin Bridge (Route 1) from the northeast
- Monsignor O'Brien Highway (Route 28) from the north
- Memorial Drive from Cambridge
- Rutherford Avenue from the north

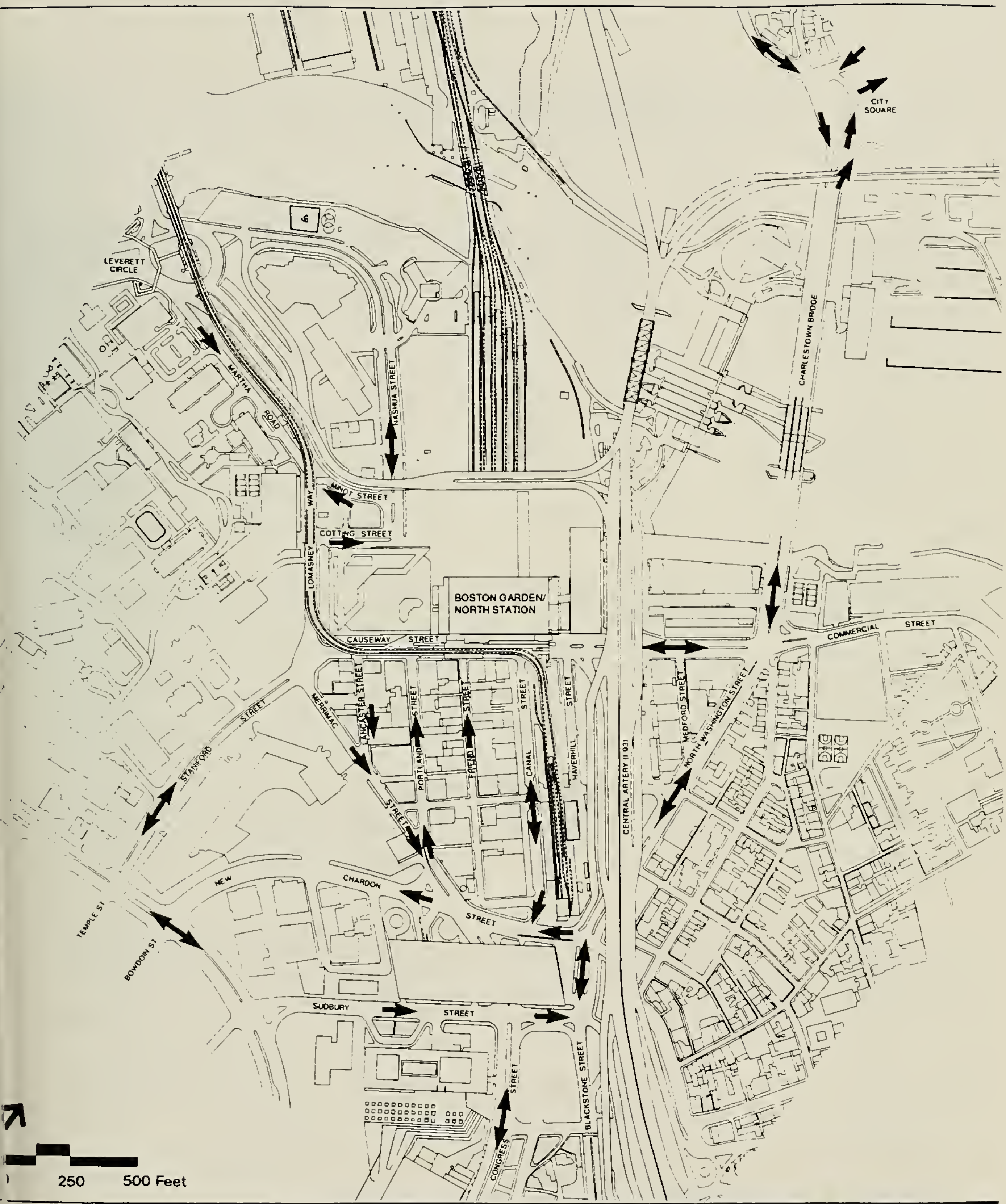
Many one-way streets exist in the study area. Figure IV-A-2 illustrates the existing roadway circulation pattern.

Geometry and Operations of Analysis Intersections

The intersections to be analyzed for this Draft EIR/PIR were specified in the scope issued by the Boston Redevelopment Authority. This section provides a description of the physical characteristics of each analysis intersection, as observed during the spring of 1990. Operating conditions observed in the field are also noted.

Leverett Circle. Leverett Circle handles traffic from three approach roadways: Storrow Drive (officially named Charles Street at this location), Nashua Street, and Charles River Dam Road. Leverett Circle is operated under police officer control from 6:30 to 9:30 AM and from 4:30 to 6:30 PM. At other times, it is signal controlled.

The Storrow Drive eastbound approach consists of four lanes. These feed into four departure lanes: one lane heading east around Leverett Circle, two lanes heading onto the I-93 and Tobin Bridge on-ramps, and one lane heading southbound on Martha Road toward the North Station area.



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Existing Roadway Circulation Figure IV-A-2

Table IV-A-3 EXISTING ROADWAY CHARACTERISTICS

Roadway (Jurisdiction)	Classification	Direction of Travel	Number of Travel Lanes	Parking
Central Artery/I-93 (Commonwealth of Massachusetts)	Divided, limited access highway	North/south	6-8	None
Charlestown Bridge (City of Boston)	Two-way arterial	North/south	4-6	None
North Washington Street (City of Boston)	Two-way arterial	North/south	4	Metered parking on both sides
Cambridge Street (City of Boston)	Two-way arterial	North/south	4-6	Metered parking on both sides
Staniford Street (City of Boston)	Two-way, divided connector	East/west	4	Metered parking on both sides
New Chardon Street (City of Boston)	One-way connector	West	3	Metered parking on both sides
Sudbury Street (City of Boston)	One-way connector	East	3	Metered parking on both sides
Merrimac Street (City of Boston)	Part one-way, part two-way connector	North/south	1-4	Metered parking on both sides
Lomasney Way (City of Boston)	Two-way connector	North/south	4	None
Causeway Street (City of Boston)	Two-way, divided connector	East/west	3-7	Metered parking, taxis, loading
Martha Road (City of Boston)	One-way connector	North/south	1	Metered parking on one side
Nashua Street (City of Boston)	Two-way, divided connector	North/south	4	Metered parking on both sides
Cotting Street* (City of Boston)	One-way connector from Lomasney Way to Nashua Street	East	2	None
Minot Street* (City of Boston)	One-way connector from Nashua Street to Lomasney Way	West	1	None

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* This area is currently affected by the MBTA garage construction. Existing conditions refers to spring 1990 conditions.

Table IV-A-3 EXISTING ROADWAY CHARACTERISTICS (Continued)

Roadway (Jurisdiction)	Classification	Direction of Travel	Number of Travel Lanes	Parking
Canal Street (City of Boston)	Two-way local street	North/south	2	Metered parking on both sides
Accolon Way (private)	Two-way private road	North/south	2	Private parking
Haverhill Street (City of Boston)	Two-way local street	North/south	2	No legal parking

* This area is currently affected by the MBTA garage construction. Existing conditions refers to spring 1990 conditions.

The Nashua Street approach to Leverett Circle consists of two through lanes heading westbound to Storrow Drive and two exclusive right-turn lanes from Nashua Street onto Charles River Dam Road. An I-93 off-ramp intersects with Nashua Street at a signal just east of Leverett Circle.

Three southbound approach lanes are provided on the dam. One of these is an exclusive right-turn lane (onto Storrow Drive), from which traffic movement is allowed at all times.

Traffic demand at Leverett Circle exceeds its capacity during both the morning and evening peak hours. Substantial queues and delays are common on the eastbound and southbound approaches. These delays are due in part to backups on the I-93 and Tobin Bridge on-ramp, caused by congestion on the Central Artery.

Martha Road, Lomasney Way, and Minot Street. This three-way, unsignalized intersection is controlled by a STOP sign on Minot Street. The one-way, southbound Martha Road approach consists of one general-purpose lane which feeds into two southbound departure lanes on Lomasney Way. The one-way westbound Minot Street approach consists of one lane; left turn is the only movement permitted. Drivers experience little delay at this location.

Lomasney Way, Cotting Street, and Public Garage. This four-way, unsignalized intersection consists of three approaches, including a public garage driveway. The one-way southbound Lomasney Way approach consists of two through lanes, which are also used for left turns onto Cotting Street and right turns into the garage. The northbound Lomasney Way approach contains two lanes, both of which are used for right turns onto Cotting Street. The left lane is used also for left turns into the garage. Cotting Street is a two-lane, one-way street flowing eastbound away from the intersection. Traffic exiting the garage forms two lanes, one for right turns onto Lomasney Way and one for the through movement to Cotting Street. Only the movement from the garage to Cotting Street experiences delay at this intersection.

Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street. This four-way, signalized intersection (also called Lowell Square) has three approaches. Causeway Street near the intersection has two westbound lanes, one wide eastbound lane, and no parking. Lomasney Way from Cotting Street to Merrimac Street is a four-lane roadway with two travel lanes in each direction and no parking. Staniford Street is a four-lane divided roadway with two travel lanes and one parking lane in each direction. Merrimac Street is one-way southbound (away from the intersection) with parking on both sides.

The only notable delays occur on Staniford Street during the evening peak hour. Traffic queues of ten to fifteen vehicles per lane are common on Staniford Street during this period.

Causeway Street and Canal Street. This unsignalized, three-way intersection is controlled by a STOP sign on Canal Street. Canal Street is a north-south two-way street with one travel lane and a metered parking lane in each direction. Eastbound Causeway Street contains two travel lanes, metered parking on the south side of the street, and a taxi stand along the center median. The westbound Causeway Street approach contains three travel lanes.

During the morning and evening peak periods the right westbound travel lane is frequently blocked by illegal parking. Traffic from Canal Street turning eastbound on Causeway Street frequently experiences delays during the peak hours due to high volumes of pedestrian traffic which cross Causeway Street as part of a daily commuting pattern to and from North Station.

Causeway Street, Accolon Way and Haverhill Street. This unsignalized, four-way intersection is controlled by STOP signs on the Accolon Way and Haverhill Street approaches. Haverhill Street has one travel lane in each direction and carries low traffic volumes. Accolon Way is a two-way, two-lane, dead-end roadway which provides access to parking lots located behind the Boston Garden. The westbound Causeway Street approach contains four travel lanes which narrow to three travel lanes on the departure side of the intersection. The eastbound Causeway Street approach contains three travel lanes.

Causeway Street, Commercial Street, and North Washington Street. This signalized intersection operates under police officer control during the morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak periods. The westbound approach (Commercial Street) consists of two through lanes of traffic and a channelized exclusive right-turn lane. The eastbound approach (Causeway Street) consists of three travel lanes, two of which are used as left-turn lanes and one as a through and right-turn lane. The Charlestown Bridge southbound approach consists of two through lanes plus exclusive right- and left-turn lanes. Sometimes, right turns off the bridge are made from the second lane as well as from the curb lane.

The intersection is heavily used during both the morning and evening peak hours, with volumes near capacity on some approaches. Conflicts between vehicular and pedestrian flows affect the intersection's capacity. Except for long queues and delays on the Charlestown Bridge approach during the morning peak hour, the intersection usually operates with only moderate delays during both the morning and evening peak hours.

City Square. City Square in Charlestown operates under police officer control during the morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak periods, and is uncontrolled at other times. City Square's present geometry is temporary and will be reconstructed as part of the Central Artery North Area (CANA) project. Four streets intersect at City Square. Rutherford Avenue runs north and south through the intersection, Chelsea Street runs east from the intersection toward the Charlestown Navy Yard, a temporary access road runs east from the intersection toward the Tobin Bridge, and Main Street runs west to the intersection, bringing traffic from the Tobin Bridge and from the local area. Traffic arriving on the southbound Rutherford Avenue approach is required to continue south across the Charlestown Bridge. When under police control, the square operates like a T-type intersection of a four-lane divided north-south arterial (Rutherford Avenue-Charlestown Bridge) and a three-lane westbound street (Main Street). Southbound left-turns are prohibited, northbound U-turns are permitted, and right-turning drivers are usually able to skirt the key conflict locations.

City Square processes high volumes of traffic during the morning and evening peak hours. Traffic congestion exists, and the intersection operates near capacity.

Cambridge Street, Staniford Street, and Temple Street. At the signalized intersection of Cambridge, Staniford, and Temple streets, pedestrians cross concurrently with traffic. The westbound Staniford Street approach to the intersection functions as one exclusive right-turn lane, one exclusive left-turn lane, and one lane of parking. The eastbound (Temple Street) approach consists of one general-purpose travel lane. The Cambridge Street northbound approach has three travel lanes, one of which is an exclusive right-turn lane. Cambridge Street southbound consists of one exclusive left-turn lane and two through lanes, plus a metered parking lane, which would normally be used for travel during the morning and evening peak periods. Currently the parking lane is used as a pedestrian walkway due to the adjacent Suffolk University building construction project.

Cambridge Street, New Chardon Street, and Bowdoin Street. This four-way, signalized intersection consists of two-way streets except for one-way westbound New Chardon Street. New Chardon Street contains three travel lanes and one lane of metered parking on each side of the street. The northbound Cambridge Street approach contains two travel lanes plus one lane of metered parking. Parking is prohibited during the evening peak hours (4:00 to 6:00 PM). The southbound Cambridge Street approach contains three travel lanes and one lane for metered parking. Bowdoin Street has two travel lanes and one metered parking lane in each direction.

The Bowdoin Street eastbound approach operates poorly during the morning and evening peak hours due to interference from New Chardon Street traffic, which flows during the same signal phase. The signal on Cambridge Street at Staniford Street, just 150 feet to the north, is generally red while Bowdoin Street and New Chardon Street vehicles have a green light. Only two through lanes on Cambridge Street are available to store these vehicles between the two intersections. The exclusive right-turn lane and green right arrow on Cambridge Street northbound at Staniford Street are of little value because drivers turning right from New Chardon Street generally do not turn right again on Staniford Street, and drivers turning left from Bowdoin Street cannot easily weave to the right-turn lane until after the storage area clears. The impacts of this situation are greatest on Bowdoin Street, where queues of ten or more vehicles per lane were observed in the evening peak hour.

New Chardon Street and Merrimac Street. This signalized intersection consists of one-way westbound New Chardon Street and two-way northbound and southbound Merrimac Street. The westbound New Chardon Street approach consists of four travel lanes. The left lane is generally used by left-turning vehicles. The intersection, as a whole, operates well, but some delays are encountered by left-turning drivers on the northbound and westbound approaches during the evening peak hour.

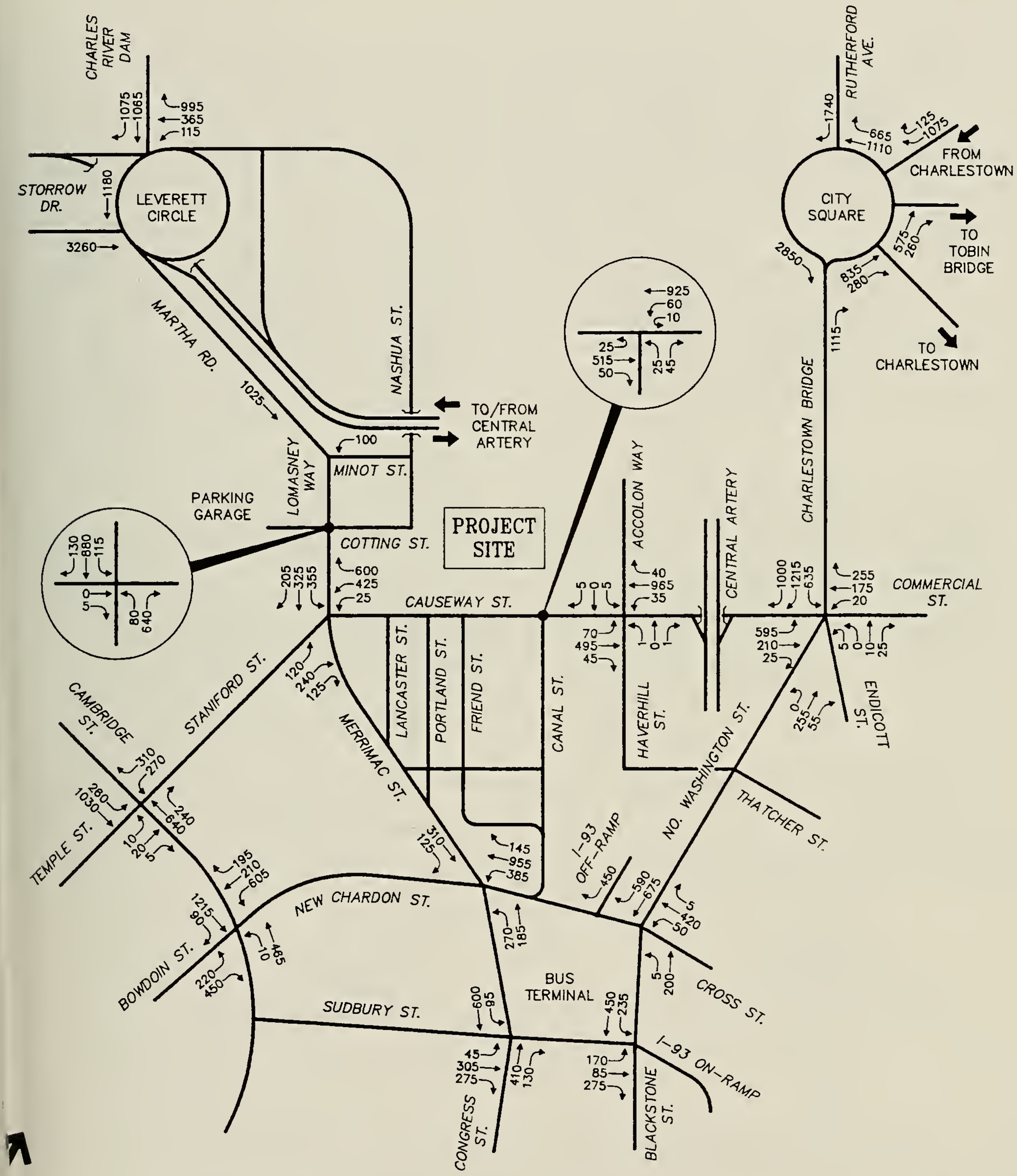
North Washington Street, Cross Street, and New Chardon Street. This signalized intersection consists of two-way northbound and southbound North Washington Street, one-way westbound Cross Street, and one-way westbound New Chardon Street. North Washington Street consists of two travel lanes in each direction and no parking in this area. Cross Street has two general-purpose travel lanes westbound. New Chardon Street consists of four departure lanes from the intersection. The intersection operates smoothly except that southbound traffic is occasionally delayed by buses waiting to enter the adjacent Haymarket bus station during the morning peak hour.

Sudbury Street, Merrimac Street, and Congress Street. This signalized intersection consists of two-way northbound and southbound Merrimac and Congress streets and one-way eastbound Sudbury Street. Merrimac Street southbound consists of two through lanes and one left-turn lane. Northbound Congress Street consists of two through lanes and a lane of metered parking. The metered parking lane becomes an exclusive, channelized right-turn lane just south of the intersection. The intersection operates smoothly except that the Sudbury Street eastbound right-turn movement is sometimes delayed during peak hours.

Sudbury Street, North Washington Street, and Blackstone Street. This signalized intersection consists of two-way North Washington Street, providing access northbound and southbound, one-way southbound Blackstone Street, and one-way eastbound Sudbury Street. Traffic approaching from Sudbury Street forms four lanes--two left-turn lanes, a through lane, and an exclusive right-turn lane. No significant delays were observed.

Traffic Volumes

Existing traffic volumes were counted manually and mechanically at key locations in the study area between March and May 1990. Automatic traffic recorders were placed on roadway links in the study area, and manual turning movement counts were conducted at all analysis intersections during the morning (7:30 AM to 9:30 AM) and evening (4:00 PM to 6:00 PM) peak periods. Turning movement counts were also conducted at all analysis locations between 6:00 PM and 8:00 PM to aid in the assessment of arena-related traffic levels. Peak hour traffic volumes are shown in Figures IV-A-3 and IV-A-4.



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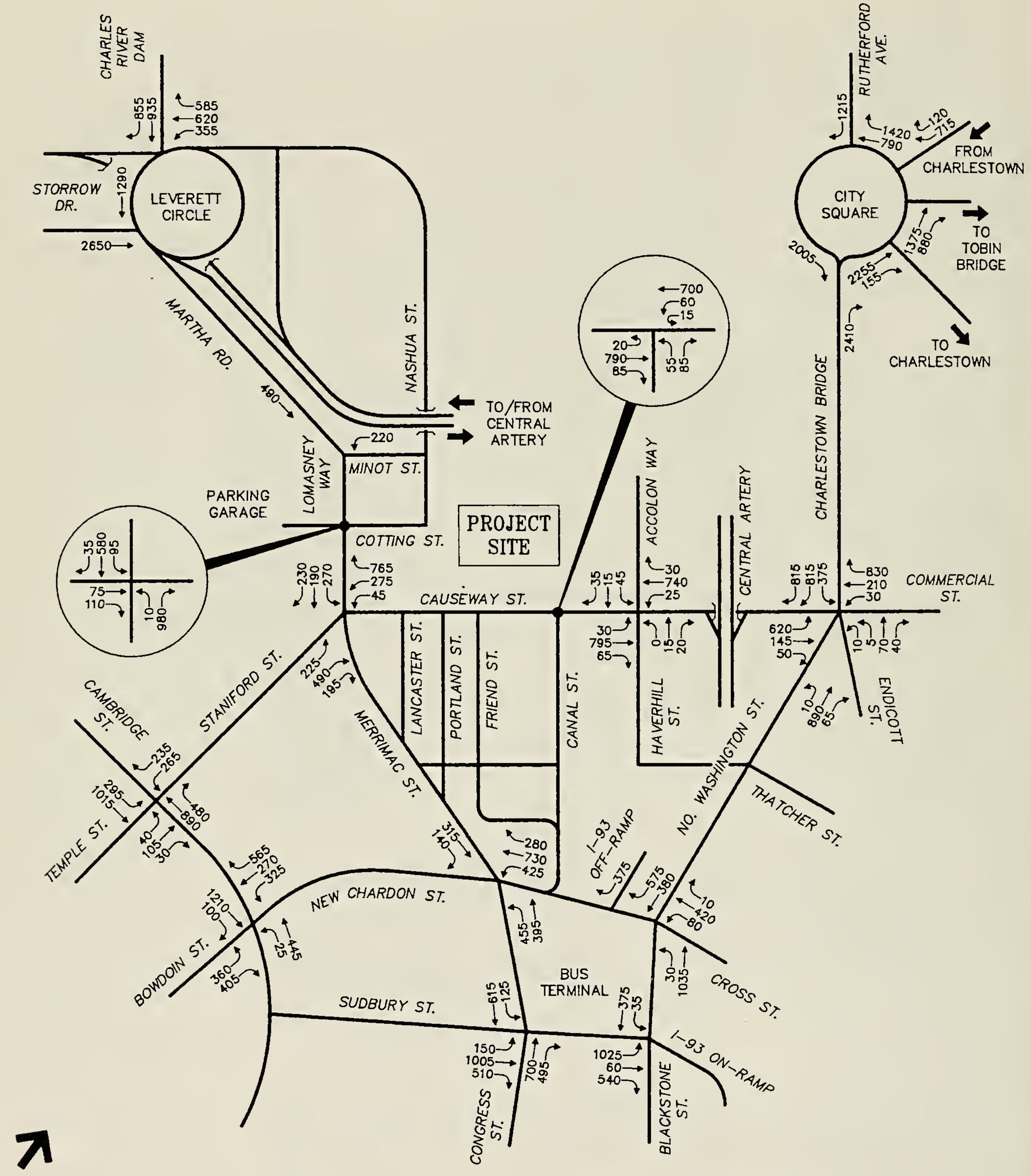
Existing Morning Peak Hour Traffic Volumes (8:00-9:00 AM)

Figure IV-A-3



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Existing Evening
Peak Hour Traffic Volumes
(5:00-6:00 PM)

Figure IV-A-4

Signalized Intersection Level-of-Service Analysis Procedure

In accordance with MEPA guidelines, an Existing conditions operations analysis was performed. To measure the quality of traffic operations, fourteen intersections within the study area were analyzed with regard to capacity and delay. The intersections were specified in the scope issued by the Boston Redevelopment Authority and adopted by the Secretary of Environmental Affairs.

A primary result of capacity analysis is the assignment of levels of service to transportation facilities under various traffic flow conditions. The concept of level of service is defined as a qualitative measure describing operating conditions within a traffic stream and their perception by motorists. A level-of-service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. In so doing, it provides an index to the quality of traffic flow.

Levels of service for signalized intersections are calculated using the operational analysis methodology of the 1985 Highway Capacity Manual (HCM).[1] This method assesses the effects of signal type, timing, phasing, progression, vehicle mix, and geometrics on delay. Level-of-service designations are based solely on the criterion of the calculated average stopped delay per vehicle, since delay is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. Table IV-A-4 summarizes the relationship between level of service and delay. The tabulated delay criteria may be applied in assigning level-of-service designations to individual lane groups, intersection approaches, or to entire intersections. Throughout this report, delays are reported for entire intersections.

Table IV-A-4 **LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS**

Level of Service	Stopped Delay per Vehicle (seconds)
A	≤5.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	>60.0

Source: Highway Capacity Manual, Special Report 209; Transportation Research Board; Washington, DC (1985).

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[1] Highway Capacity Manual, Special Report 209; Transportation Research Board, Washington, DC (1985).

These calculated delays cannot be directly related to intersection capacity. It is possible to have delays in the level-of-service F range without exceeding capacity. This is possible if one or more of the following conditions exist:

- Long signal cycle lengths
- A particular traffic movement experiences a long red time
- Progressive movement for a particular lane group is poor

As required by the EIR guidelines issued jointly by the Secretary of Transportation and Construction and the Secretary of Environmental Affairs, level-of-service analyses for signalized intersections were conducted using a computer program (CINCH)[2] based on the 1985 Highway Capacity Manual. Several adjustments were made to the input data in order to calibrate computer results with observed morning and evening peak hour conditions. The field observations were conducted between March and May 1990, during the same period in which traffic count data were collected. The rationale behind these adjustments is explained in this section, and all adjustments are shown in the Technical Data appendix.

One clear indication of a defect in the unadjusted analysis procedure is an existing volume-to-capacity ratio (v/c) significantly greater than 1.0 for any intersection approach or lane group. By definition, capacity is the maximum number of vehicles that can be processed. Existing volume, therefore, cannot exceed capacity, and v/c cannot exceed 1.0 for Existing conditions.

Left Turns. The Highway Capacity Manual, which is based on typical national norms for vehicle operation, assumes that left-turning drivers yield the right-of-way to opposing traffic, waiting for a sufficiently long gap in the opposing flow so that opposing traffic will not have to slow or stop to avoid a collision. The manual includes capacity reduction factors based on the above assumption and on the volume of opposing traffic.

The capacity reduction factors calculated from formulas in the manual are sometimes much too severe because the manual does not recognize the fact that, under congested conditions, drivers typically abandon the right-of-way concept and resort to a less structured way of dealing with conflicting movements. Often, one left-turning driver will accept a very short gap, forcing the opposing traffic to slow down or stop. This first driver is typically followed by a tightly packed platoon of left-turning vehicles.

There is no conclusive evidence that either "rule of the road" for left turns is any safer than the other. Where the traditional right-of-way rules are strictly followed, drivers in the through traffic stream may be more complacent and less able to avoid a collision when a left-turning driver under-estimates the available gap time. Where the less structured system prevails, drivers are forced to remain alert to conflicting movements.

2/ The Capacity of Intersections: CTPS's HCM Software (CINCH); Boston: Central Transportation Planning Staff (1987).

In any case, the system used in congested conditions increases the capacity of intersections in general, and left-turn lanes in particular, compared with the capacity reductions called for in the Highway Capacity Manual. Analysis which fails to adjust the HCM procedure to reflect field observations yields erroneous results for existing conditions and, therefore, invalid predictions of future conditions.

For example, an unadjusted analysis of the intersection of Cambridge, New Chardon, and Bowdoin Streets under existing evening peak hour conditions is presented in the Technical Data appendix. That unadjusted analysis yields a volume-to-capacity ratio of 2.11 for Bowdoin Street left turns; in other words, the unadjusted analysis states that the number of vehicles observed turning left during the hour is more than twice the maximum that physically could have done so. The 2.11 v/c reported by CINCH for Existing conditions is proof that the unadjusted HCM procedure underestimates the left-turn capacity by half on this movement.

In this Draft EIR/PIR, left-turn capacity reduction factors have been adjusted at three locations:

- On the Bowdoin Street approach described above, the left turn reduction factor was improved (increased) to 0.75 to reflect field observations. (While the CINCH program has no mechanism to allow direct adjustments to left-turn factors, it allows the analyst to achieve the desired result by means of a compensating increase in the "ideal saturation flow rate," discussed later.)

- On the Staniford Street approach to Cambridge Street, unadjusted analysis again yielded erroneous results for left turns. The unadjusted analysis concluded that the capacity to process left turns was substantially less than the number actually processed. This error occurred because the HCM technique assumed that drivers turning left from Staniford Street would yield to drivers coming out of Temple Street. In fact, Temple Street is perceived as a driveway more than a street, and through traffic from Temple Street generally has to yield to left-turning traffic from Staniford Street. To represent this condition accurately, Staniford Street left turns were represented as through movements in the analysis.

- To model accurately existing traffic conditions at the intersection of Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street, left turn volumes on Staniford Street and on Causeway Street were converted into equivalent through volumes by using the adjustment called for in Transportation Research Circular 212.[3]

Right Turns. Right-turning traffic at study area intersections experiences varying amounts of delays due to different traffic conditions. The Highway Capacity Manual takes into account only some of the various traffic conditions for right-turning vehicles. In particular, the Highway Capacity Manual does not account for the following conditions:

- Right Turns Aided by Traffic Islands. At the intersection of Causeway Street, North Washington Street and Commercial Street, westbound right-turn traffic is aided by a triangular island. The Highway Capacity Manual applies a capacity reduction factor of 0.85 for all right turns due to the delay experienced by right-turning traffic at standard intersections. At this intersection, however, right-turning traffic is processed as efficiently as through traffic, and a capacity reduction factor does not reflect observed traffic conditions. Therefore, the right-turn penalty was eliminated by means of a compensating increase in the saturation flow rate for that movement.

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[3] Interim Materials on Highway Capacity, Transportation Research Circular 212; Transportation Research Board; Washington, DC (January 1980).

- Right Turns Which Occur Before the Intersection STOP Line. At the City Square intersection, traffic turning right onto Main Street often does not experience any delay when through traffic is stopped. This is because the right turn is made about 100 feet before the stopping point. However, when through traffic queues back to the right turn exit lane, right turning traffic is delayed. It was assumed for the analysis that a portion of the right turning traffic was delayed by the through traffic queue. In order to reflect conditions observed in the field, a portion of the right-turn volume was excluded from analysis based on the geometric data and the traffic volume distribution.

Ideal Saturation Flow Rate. The Highway Capacity Manual assumes that 1,800 vehicles per lane per hour of green time can pass through an intersection under "ideal" (meaning highest capacity) conditions. Field observations conducted at Boston-area urban locations concluded that the ideal saturation flow is approximately 1,950 vehicles per hour. Nevertheless, in deference to the MEPA guidelines for EIRs, 1,800 was used routinely in this draft EIR/PIR, except at two intersections, where field observations definitively required an adjustment. Those two exceptions are described below.

At Leverett Circle, eastbound approach traffic on Storrow Drive is split among four lanes. The majority of this traffic, especially in the evening, is destined for the two-lane ramp leading to I-93 and the Tobin Bridge. The remaining traffic departs onto Martha Road or continues around the circle to Charles River Dam Road. Due to capacity limitations on the ramp, traffic cannot flow at ideal rates. To account for this fact, the ideal saturation flow rate (1,800) was **reduced** to 1,700 in the morning and to 1,450 in the evening for each of the four lanes on Storrow Drive.

At Keany Square, traffic counts for certain movements significantly exceeded the capacities estimated by the standard procedures. As discussed earlier, this fact invalidates the capacity estimates. Since left-turn and right-turn adjustment factors were not the cause of the problem in this case, the discrepancy can only be attributed to the fact that more than 1,800 vehicles per lane per hour of green time travel through this intersection during peak periods. Ideal saturation flow rates were **increased** to 1,850 for most movements at this location. Flow rates per lane were **reduced** to 1,300 for southbound through traffic (to reflect bridge construction) and to 1,650 (morning) and 1,600 (evening) for southbound right turns (to reflect congestion in the Causeway Street departure lanes).

Level-of-Service Results

Level-of-service analyses for morning and evening peak-hour traffic operations were conducted for the seven signalized and three police officer-controlled intersections in the study area. Intersections under police officer control during the morning and evening peak hours were analyzed as signalized locations because police officers, like signals, typically provide an orderly management of conflicting traffic streams. Table IV-A-5 summarizes the results of the analysis.

Table IV-A-5 **EXISTING LEVEL OF SERVICE - SIGNALIZED INTERSECTIONS**

		Morning Peak Hour			Evening Peak Hour		
Location Number	Intersection	V/C*	Delay**	LOS***	V/C	Delay	LOS
1	Leverett Circle	1.00	60+^	F	1.01	60+^	F
4	Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street	0.70	30	D	0.66	26	D
7	Causeway Street, North Washington Street, and Commercial Street	1.01	49	E	1.01	45	E
8	City Square	1.02	39	D	0.98	26	D
9	Cambridge Street, Staniford Street, and Temple Street	0.68	24	C	0.76	18	C
10	Cambridge Street, New Chardon Street, and Bowdoin Street	0.80	37	D	0.84	47	E
11	New Chardon Street and Merrimac Street	0.65	18	C	0.77	29	D
12	New Chardon Street and North Washington Street	0.74	22	C	0.63	14	B
13	Sudbury Street, Merrimac Street, and Congress Street	0.55	22	C	0.86	29	D
14	Sudbury Street, North Washington Street, and Blackstone Street	0.51	18	C	0.61	21	C

* Volume-to-capacity ratio.

** Average stopped delay per vehicle in seconds.

*** Level of service.

^ Delay for Leverett Circle is estimated to be more than 60 seconds; therefore, LOS F results. The volume processed equals the capacity, but the demand exceeds the volume processed, causing long queues.

As indicated in Table IV-A-5, traffic operations at seven of the ten signalized intersections operate at acceptable levels of service (LOS D or better) during both the morning and evening peak hours. The three intersections which currently operate at deficient levels of service are:

- Leverett Circle (both peak hours)
- Causeway Street, North Washington Street, and Commercial Street (both peak hours)
- Cambridge Street, New Chardon Street, and Bowdoin Street (evening peak hour only)

Leverett Circle processes a large amount of traffic volume during the morning and evening peak hours. Moreover, the arrival rate exceeds the rate at which vehicles can be processed. This results in long queues and delays. Consequently, Leverett Circle operates at level-of-service F during both peak hours.

At the intersection of Causeway Street, North Washington Street, and Commercial Street, traffic volumes are also relatively high. The Charlestown Bridge, which is currently under construction, processes a large amount of traffic southbound during the morning peak hour and northbound during the evening peak hour. This results in LOS E in both peak hours.

At the intersection of Cambridge Street, New Chardon Street, and Bowdoin Street, delays are experienced by traffic heading eastbound on Bowdoin Street. Drivers on the New Chardon Street approach also experience some notable delays. The reason for these delays was discussed earlier under Geometry and Operations of Analysis Intersections. Level-of-service E results during the evening peak hour. Due to coordination with the signal at Cambridge Street and Staniford Street, through traffic on Cambridge Street flows quite smoothly.

Unsignalized Intersection Level-of-Service Analysis Procedures

Level of service for unsignalized intersections is determined by a procedure described in the 1985 Highway Capacity Manual. The procedure accounts for lane configurations on both the minor and major approaches, conflicting traffic stream volumes, and type of intersection control (STOP versus YIELD). First, using a gap analysis procedure, the maximum capacity (or possible flow of vehicles) for each minor approach lane is calculated. These capacities are then compared to the demands. The difference between available capacity and demand is defined as available reserve capacity (ARC) and is used as the criterion for determining level of service and estimating expected delay to minor street traffic. Table IV-A-6 summarizes the relationship between reserve capacity, level of service, and expected delay to minor street traffic.

Level-of-Service Results. Level-of-service analyses were performed at four unsignalized intersections in the study area. These include:

- Martha Road and Minot Street
- Lomasney Way and Cotting Street

- Causeway Street and Canal Street
- Causeway Street, Accolon Way and Haverhill Street

The results of these analyses are presented in Table IV-A-7.

Table IV-A-6 **LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS**

Available Reserve Capacity (passenger cars per hour)	Level of Service	Expected Delay to Minor Street Traffic
400 or more	A	Little or no delay
300-399	B	Short traffic delays
200-299	C	Average traffic delays
100-199	D	Long traffic delays
0- 99	E	Very long traffic delays
*	F	Extreme Delays

* Demand volume exceeds capacity.

Source: Transportation Research Board; Special Report 209, Highway Capacity Manual; Washington, DC (1985).

Table IV-A-7 **EXISTING LEVEL OF SERVICE - UNSIGNALIZED INTERSECTIONS**

Location Number	Intersection and Critical Movement	Morning Peak Hour		Evening Peak Hour	
		ARC*	LOS**	ARC	LOS
2	Martha Road and Minot Street:				
	All moves from Minot Street	353	B	555	A
3	Lomasney Way and Cotting Street:				
	From public garage to Cotting Street	90	E	27	E
5	Causeway Street and Canal Street:				
	All moves from Canal Street	121	D	-6	F
6	Causeway Street, Accolon Way, and Haverhill Street:				
	All moves from Accolon Way	115	D	4	E

* Available reserve capacity.

** Level of service.

During the morning peak hour, all four of the analyzed unsignalized study area intersections operate at an acceptable level of service (LOS D or better). During the evening peak hour, level-of-service results are deficient for the following traffic movements: movements from the public garage onto Cotting Street, all moves out of Canal Street, and all moves out of Accolon Way. It should be noted, however, that field observations during the morning and evening peak periods indicate satisfactory traffic operations on the main streets and only moderate delays on minor approaches at these unsignalized intersections. The analysis technique assumes minor street traffic always yields to main street traffic. This is not always true, especially along Causeway Street, where speeds are low.

Accident Analysis

As required by the MEPA scope for this draft EIR/PIR, accident data for the fourteen analysis intersections were obtained from the Massachusetts Department of Public Works (MDPW). The data cover the three-year period from January 1986 to December 1988 (1989 data were not available). The data are presented in Table IV-A-8 and described below:

- During the three-year study period, 127 accidents were reported at the fourteen study area intersections.
- The intersections experiencing the greatest average number of reported accidents were Leverett Circle (73 accidents) and City Square (23 accidents).
- No fatalities were reported at any of the study area intersections during the three-year period.

Not all accidents are reported to the MDPW. The actual number of accidents is probably greater than the number included in the MDPW records.

Parking

Analysis Area

A large supply of public and private off-street parking is provided within the area of the proposed development. A limited supply of on-street parking is also available. Figure IV-A-5 shows the location of existing parking facilities in the study area (as of spring 1990) as well as the designated parking zones used in the parking analysis. Some of the planned changes to parking supply are beginning to occur. However, it is important to report the parking situation as it stood in the spring of 1990, when the traffic and parking data were collected.

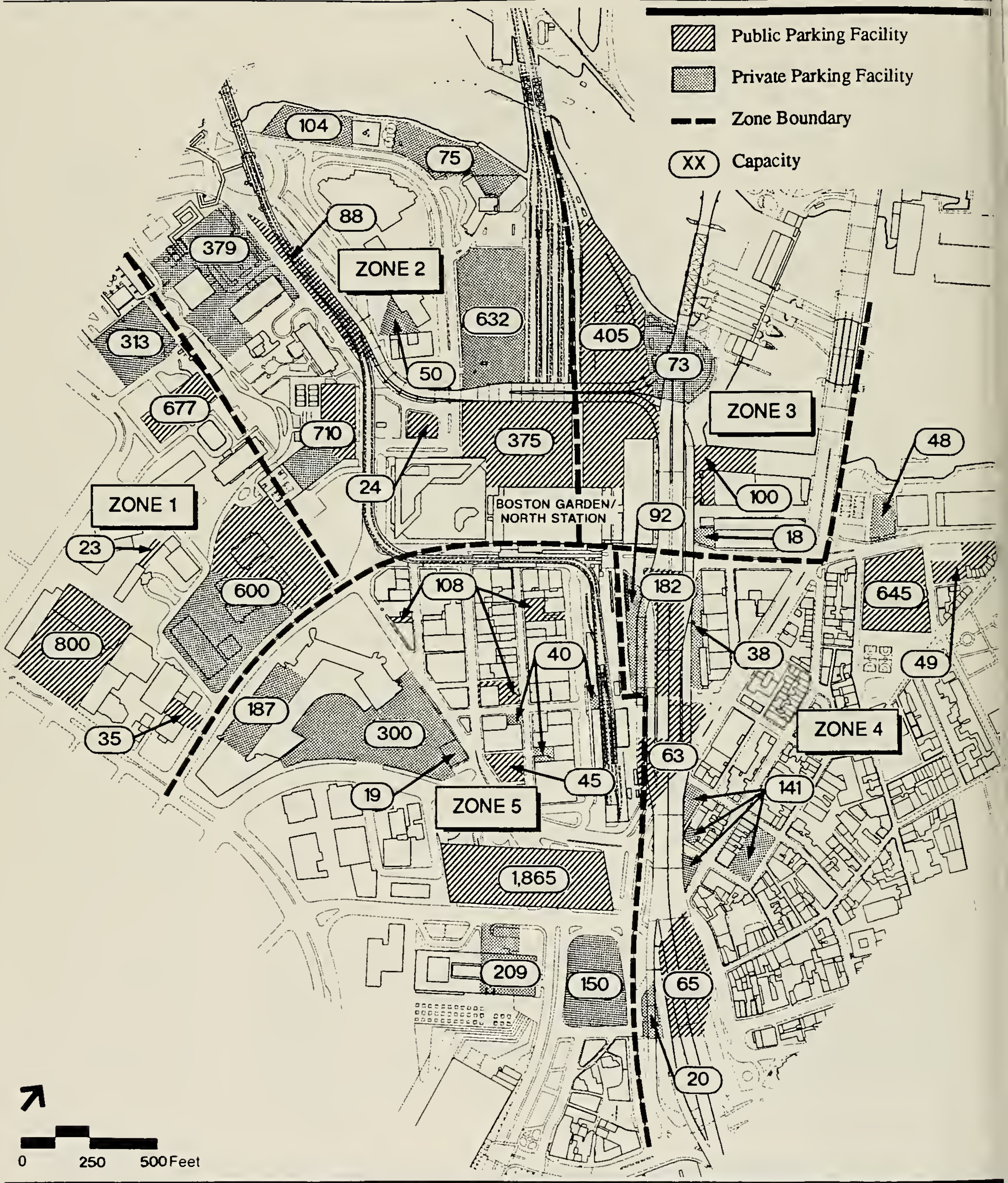
Table IV-A-8 MDPW ACCIDENT DATA SUMMARY (1986 - 1988)

Location Number	Location	Year 1986	1987	1988	Average Accidents Per Year
1	Leverett Circle	86	75	57	73
2	Martha Road and Minot Street	0	0	0	0
3	Lomasney Way and Cotting Street	0	0	0	0
4	Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street	1	1	2	1
5	Causeway Street at Canal Street	0	2	4	2
6	Causeway Street, Haverhill Street, and Accolon Way	1	0	0	*
7	Causeway Street, North Washington Street, and Commercial Street	3	2	8	5
8	City Square	22	19	27	23
9	Cambridge Street, Staniford Street, and Temple Street	1	4	8	4
10	Cambridge Street, New Chardon Street, and Bowdoin Street	5	7	5	6
11	New Chardon Street and Merrimac Street	2	5	5	4
12	New Chardon Street and North Washington Street	0	1	2	1
13	Sudbury Street, Merrimac Street, and Congress Street	7	4	8	6
14	Sudbury Street, North Washington Street, and Blackstone Street	1	3	1	2
	TOTAL	129	123	127	127

* Less than 1.

Capacity and Utilization

Table IV-A-9 presents the existing off-street parking supply and accumulation (utilization) in an area within approximately 2,000 feet of Boston Garden. The data are presented for the five parking analysis zones shown in Figure IV-A-5. This information was obtained from the Boston Transportation Department's (BTD) 1987 Downtown Boston Parking Inventory Survey. The inventory includes 9,833 off-street parking spaces within the study area. Of these, 5,851



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Study Area Parking Facilities and Zones Spring 1990

Figure IV-A-5

are public spaces and 3,982 are private spaces. In addition, there is a limited amount of on-street metered parking in the North Station area that is not included in the table.

Table IV-A-9

SUMMARY OF EXISTING (SPRING 1990) OFF-STREET PARKING SUPPLY AND ACCUMULATION (WITHIN 2,000 FEET OF BOSTON GARDEN)

		Accumulation	
Zone (See Figure IV-A-5)	Capacity	10:00 AM	12:00 Noon
Zone 1	2,448	2,257	2,258
Zone 2	2,475*	2,370	2,424
Zone 3	596	569	575
Zone 4	1,299	1,210	1,213
Zone 5	3,015**	2,778	2,871
Public Total	5,851	5,511	5,706
Private Total	3,982	3,673	3,635
TOTAL	9,833	9,184	9,341
Public Percent Occupied		94.2	97.5%
Private Percent Occupied		92.2%	91.3%
TOTAL PERCENT OCCUPIED		93.4%	95.0%
Additional Spaces	165***		
TOTAL SUPPLY	9,998		

Source: Boston Transportation Department, Off-street Downtown Parking Inventory, 1987.

* 126 spaces of the 2,475 spaces in Zone 2 in the 1987 inventory no longer existed in spring 1990.

** 92 spaces of the 3,015 spaces in Zone 5 in the 1987 inventory no longer existed in spring 1990.

*** 165 additional spaces exist in private facilities that were not included in the 1987 BTD parking inventory (See Technical Data appendix for details).

Accumulation of parked vehicles at 10:00 AM and 12:00 Noon on a typical weekday is also presented in the table. Of the 5,851 public parking spaces in the area, 94.2 percent were occupied at 10:00 AM and 97.5 percent were occupied at noon. Of the 3,982 private parking spaces for which accumulation data were available, 92.2 percent were occupied at 10:00 AM and 91.3 percent were occupied at noon. For all parking facilities within 2,000 feet of Boston Garden, 93.4 percent were occupied at 10:00 AM and 95.0 percent were occupied at noon.

These accumulation rates represent a situation of essentially full occupancy with little or no excess capacity. It should be noted that some garage operators and managers have recently reported that demand has eased somewhat due to economic conditions. As a result, excess capacity may currently be available in the North Station area. No comprehensive surveys of parking utilization throughout the area have been conducted recently. In addition, the length and extent of the current economic slowdown are unknown. Because full recovery may be possible by 1995 and the actual extent of reduced demand cannot be determined, the parking analysis in this report is based on the 1987 BTD survey.

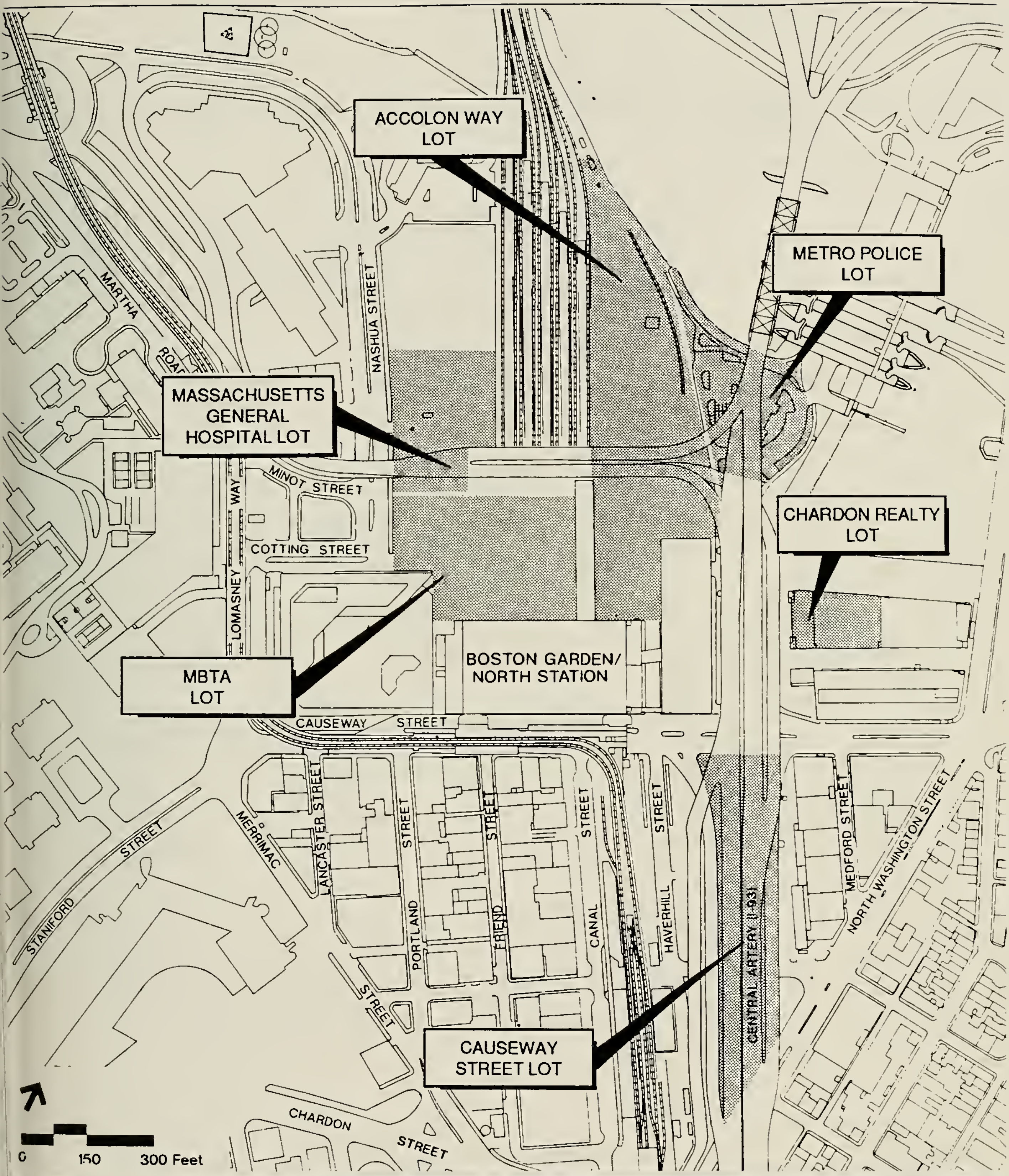
In the near future, significant changes to the parking supply are anticipated. Many of these spaces will be lost either temporarily or permanently due to reconstruction of the Central Artery and the MBTA Green Line relocation. In addition, the MBTA is constructing a new underground parking garage at North Station to replace some of the parking that will be lost due to these projects. Specific changes in the parking supply in the area of Boston Garden are presented in the Probable Project Impacts section.

To evaluate parking accumulation characteristics on Garden event days as compared to non-event days, parking accumulation counts were conducted at six parking facilities near Boston Garden. These locations are illustrated in Figure IV-A-6. Permission to conduct accumulation counts in additional facilities could not be obtained. The counts were conducted over the course of the day on three event days and three non-event days. Vehicle accumulation was recorded at approximately 10:00 AM, 2:00 PM, 6:00 PM, and 8:00 PM on each day.

Table IV-A-10 presents the parking accumulation data for event days versus non-event days. As might be expected, the mid-morning and mid-afternoon accumulation is not significantly different for event and non-event days. Also, as might be expected, all lots have higher vehicle accumulation at 6:00 PM on event days although average utilization was approximately 50 percent. Significantly higher vehicle accumulation at 8:00 PM on event days was observed. All lots surveyed were at or over capacity during this period. Vehicle accumulation ranged from 7 percent over capacity to more than double the capacity of the lot, indicating that the lots were managed by attendants during Garden events to maximize the utilization of the space available in the lot.

Existing Boston Garden Parking Demand

Under existing conditions, evening basketball and hockey games are the most typical events at the Boston Garden throughout the year and will continue to be in the new arena. They have, therefore, been selected as the basis for evaluating project impacts. Based on the result of surveys conducted at both a basketball game and a hockey game (see Arena Patron Survey Results presented in a subsequent section), the estimated parking demand during a sold-out event can be calculated. The number of person trips (which is equal to the number of seats available) was multiplied by the percentage of patrons who travel to Boston Garden by automobile and divided by the average number of people per vehicle (vehicle occupancy rate) to obtain the estimated parking demand generated by a Boston Garden event. Table IV-A-11 presents the parking demand calculated for each of these events by seat type. As illustrated in Table IV-A-10 above, the peak parking demand for events at Boston Garden takes place primarily during the evening and does not coincide with the peak parking demand for the office and retail components of the project (see below). Therefore, the public supply of almost 5,900 spaces available in the area (from Table IV-A-9) is sufficient to accommodate the demand.



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Parking Facility Accumulation Count Locations

Figure IV-A-6

Table IV-A-10 PARKING ACCUMULATION COMPARISON - EVENT DAY AND NON-EVENT DAY

		Percent Occupied*							
		10:00 AM**		2:00 PM**		6:00 PM**		8:00 PM**	
Parking Facility^	Observed Capacity***	Event Day	Non-Event Day	Event Day	Non-Event Day	Event Day	Non-Event Day	Event Day^^	Non-Event Day
Nashua Street (MGH)^^^	470	--	--	--	--	--	--	107%	34%
45 Nashua Street (MBTA)	85	65%	65%	78%	67%	41%	12%	174%	2%
140-150 Causeway Street	254	65%	63%	59%	71%	46%	24%	130%	7%
147 Causeway Street	182	103%	102%	107%	105%	64%	27%	209%	6%
131 Beverly Street	70	73%	71%	81%	76%	50%	26%	186%	16%
MDC Lot	140	79%	80%	84%	82%	41%	21%	111%	12%
TOTAL	1,201	78%	77%	81%	82%	49%	23%	137%	18%

* Average of three-day accumulation counts (April 12, 13, and 17 for event days and April 24, May 2, and May 5 for non-event days).

** Time is approximate.

*** Parking capacity is as of spring 1990 and does not always match the capacities presented in the 1987 BTD inventory due to changes in conditions since 1987. Also, the capacity is based on counts of marked spaces. Additional vehicles can be accommodated in the driving aisles.

^ Where owner's permission was provided.

^^ Managed by attendants during Boston Garden events.

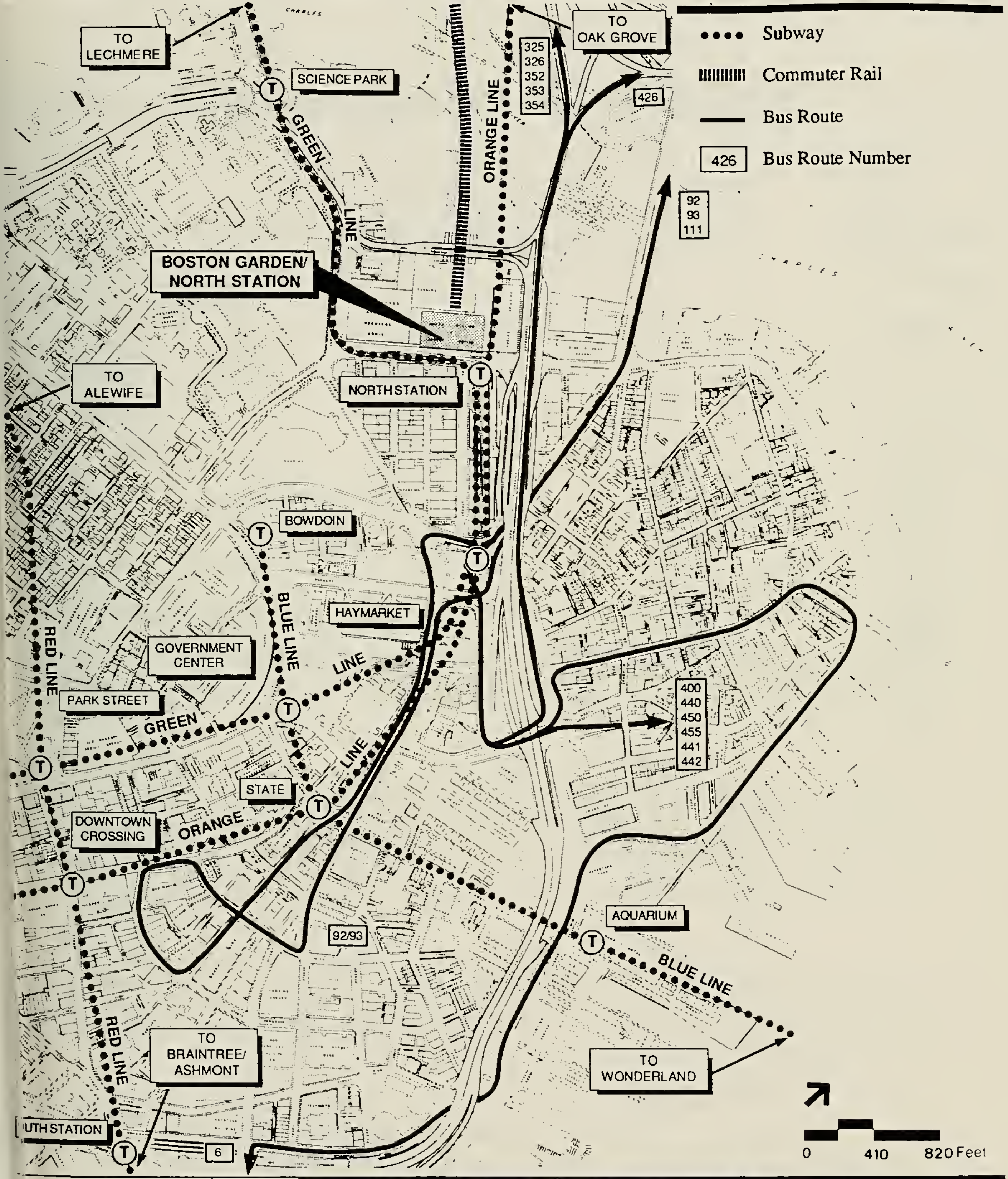
^^^ Available for public parking only during the evening.

Public Transportation

The project site is well located in relation to public transportation services. Figure IV-A-7 shows the existing facilities and services in the area. These include two of the four rapid transit lines operated by the Massachusetts Bay Transportation Authority (MBTA), four commuter rail lines, and sixteen local and express MBTA bus routes.

Rapid Transit

The North Station Green Line and Orange Line stations are located directly across Causeway Street from the project site. The Orange Line runs north across the Charles River through Charlestown to its terminus in the northern suburbs and south through downtown Boston and Roxbury to Jamaica Plain. The Green Line runs north across the Charles River to East Cambridge and south through downtown Boston to Copley Station, where it splits into two branches: the Arborway (E) branch and a second branch, which splits further at Kenmore Station into the Boston College (B) branch, the Cleveland Circle (C) branch, and the Riverside (D) branch.



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Location of Public Transportation Figure IV-A-7

Table IV-A-11 ESTIMATED PARKING DEMAND FOR EXISTING BOSTON GARDEN SPORTS EVENTS

Game/Seat Type	Seating Capacity	Percent of Person Trips By Parked Auto*	VOR**	Parking Demand	Parking Spaces per Seat
Hockey:					
Skybox	440	84.6%***	2.23***	167	0.379
General	13,982	72.4%	2.38	4,253	0.305
TOTAL	14,442			4,420	
Basketball:					
Skybox	440	78.2%	2.25	153	0.348
General	14,450	66.9%	2.40	4,028	0.279
TOTAL	14,890			4,181	

* Based on survey results (see Arena Patrons Survey Results section). Does not include drop-off trips.

** Vehicle Occupancy Rate (average people per vehicle), also based on survey results

*** The hockey skybox factors were estimated by multiplying the hockey general seating factors by the ratio of the basketball skybox factors to the basketball general seating factors.

The Red and Blue lines can be accessed via transfer from either the Green or Orange lines. Transfer points to the Red Line occur at Park Street from the Green Line and at Downtown Crossing from the Orange Line. The Red Line runs northwest to Cambridge and south to Dorchester, Quincy, and Braintree. The Blue Line, which runs northeast through East Boston to Logan Airport and Revere, can be accessed via a transfer from the Green Line at Government Center or from the Orange Line at State.

Capacity. Table IV-A-12 shows the service frequency and capacity of each rapid transit line for the peak direction in the evening peak hour (4:45 to 5:45 PM). Line capacities are calculated from the car capacities used by the MBTA for planning purposes, although heavier passenger loads are often observed on the system.

Ridership. Analysis of a rapid transit line necessarily focuses on the segment with the highest ridership. The service demand in the heavier ("peak") direction on that peak load segment must be closely monitored and periodically forecasted. This is because demand directly influences the amount of service required and, hence, the operating cost and the size of the vehicle fleet. Passenger trips that do not pass through a peak load segment in the peak direction are of lesser concern because they generally do not affect either the service plan or the budget.

Table IV-A-12 EXISTING RAPID TRANSIT LINE CAPACITY - EVENING PEAK HOUR, PEAK DIRECTION*

Line/Segment	Average Cars/ Train	Average Headway (minutes)	Average No. of Trains	Planning Capacity of Car**	Planning Capacity of Line
Orange Line/North-South Oak Grove-Forest Hills	6.0	5.0	12.0	155	11,150
Green Line/West Boston College Cleveland Circle Riverside Huntington Avenue	1.7	1.2	50.2	130	11,100
Green Line/North Lechmere	2.0	8.0	7.5	130	1,950
Red Line/North Ashmont-Alewife Braintree-Alewife	5.1	4.0	15.0	180	13,700
Red Line/South Alewife-Ashmont Alewife-Braintree	5.2	3.5***	17.0	180	15,900
Blue Line Bowdoin-Wonderland	4.0	3.0	20.0	110	8,800

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* Green Line/West data are based on observations by Vanasse Hangen Brustlin, Inc., during the spring of 1990. All other information is from schedules obtained from the MBTA.

** The MBTA uses these capacity estimates for planning purposes. Heavier loads can be carried and are often observed on the system.

*** Southbound service is more frequent than northbound because two additional southbound trains are scheduled during the peak hour.

To set a foundation for analysis of the impacts of the New Boston Garden Development on the MBTA rapid transit system, it is necessary to compare peak hour, peak direction ridership with capacity at the system's seven peak load points. The transit analysis locations, unlike signalized intersection analysis locations, do not depend on the site of the proposed project. When transit impacts occur, they occur on these critical segments, regardless of their distance from the project site.

The MBTA periodically counts in-vehicle passengers at peak load segments. On the Orange Line, for example, the peak load segments are Haymarket-North Station and New England Medical Center-Back Bay Station. On the Green Line, the peak load segments are Arlington-Copley and Science Park-Lechmere. Table IV-A-13 compares current ridership with current capacity. At all peak load segments on the system, evening peak hour ridership is currently within planning capacity.

Table IV-A-13 EXISTING RAPID TRANSIT CAPACITY AND RIDERSHIP - EVENING PEAK HOUR OUTBOUND

Line/Direction (Peak Load Segment)	Planning Capacity of Line*	Ridership at Peak Load Segment**	Ridership as Percent of Capacity
Orange Line/North (Haymarket-North Station)	11,150	8,400	75%
Orange Line/South (N.E. Medical Center-Back Bay Station)	11,150	7,600	68%
Green Line/West (Arlington-Copley)	11,100	10,100	91%
Green Line/North (Science Park-Lechmere)	1,950	1,250	64%
Red Line/North (Kendall-Central)	13,700	7,400	54%
Red Line/South (Broadway-Andrew)	15,900	9,500	60%
Blue Line/North (Aquarium-Maverick)	8,800	6,300	72%

* Green Line/West data are based on observations by Vanasse Hangen Brustlin, Inc., during the spring of 1990. All other information is from schedules obtained from the MBTA.

** Green Line/West ridership figures are taken from observations by Vanasse Hangen Brustlin, Inc., during the spring of 1990. All other ridership information is from observations by the Central Transportation Planning Staff in the spring of 1989.

It should be noted that neither service demand nor service delivery occurs uniformly over the peak hour. Often there are surges in demand or gaps in service. In such cases, trains become overcrowded and some passengers are forced to wait for another train.

When this study began, the MBTA Operations Department staff suggested that the Green Line segment between Haymarket and North Station would be most vulnerable to overloading due to an arena event. The staff therefore asked that observations be conducted of Green Line trains leaving Haymarket for North Station between 4:00 PM and 8:00 PM on several evenings on which Boston Garden events were scheduled.

The observations requested by the MBTA were conducted on three Garden-event evenings in the fall of 1989. As shown in Table IV-A-14, ridership was well below planning capacity in each of the four hours on each of the three evenings observed. Less than half of the planning capacity was utilized.

Commuter Rail

The MBTA's commuter rail trains are operated by Amtrak from North Station and South Station. The system is comprised of nine branches, including Rockport/Ipswich, Haverhill/Reading, Lowell, Gardner/Fitchburg, Framingham, Needham, Franklin, Attleboro/Stoughton, and Fairmont/Readville.

Table IV-A-14

GREEN LINE SERVICE AND RIDERSHIP - EVENING PEAK HOUR OUTBOUND DEPARTING FROM HAYMARKET STATION

Date/Time	Cars	Planning Capacity	Ridership	Ridership as Percent of Capacity
10/26/89:				
4:00-5:00 PM	35	4,550	1,520	33%
5:00-6:00 PM	34	4,420	1,630	37%
6:00-7:00 PM	33	4,290	900	21%
7:00-8:00 PM	16	2,080	860	41%
11/2/89:				
4:00-5:00 PM	43	5,590	1,540	32%
5:00-6:00 PM	36	4,680	1,500	32%
6:00-7:00 PM	33	4,290	930	22%
7:00-8:00 PM	16	2,080	880	42%
11/15/89:				
4:00-5:00 PM	44	5,720	1,550	35%
5:00-6:00 PM	34	4,420	1,400	32%
6:00-7:00 PM	34	4,420	1,490	34%
7:00-8:00 PM	19	2,470	790	32%

Existing, evening peak period, outbound seating capacity on the commuter rail lines is approximately 19,300, as shown in Table IV-A-15. Evening peak period outbound ridership (spring 1990) is estimated by the MBTA at approximately 17,200 passengers. The MBTA is continuing to acquire new coaches to serve its expanding ridership. By 1999, the MBTA expects to increase its commuter rail fleet capacity by 72 percent through acquisition of new bi-level coaches.

Bus Service

The MBTA currently operates the following sixteen bus routes that serve the North Station area:

- Route 6 (Marine Industrial Park - Haymarket Station)
- Route 92 (Assembly Square - Downtown via Sullivan Station)
- Route 93 (Sullivan Station - Downtown)

Table IV-A-15 SPRING 1990 EVENING PEAK PERIOD* COMMUTER RAIL SERVICE AND RIDERSHIP

Branch	Number of Trains	Total Number of Coaches	Total Seat Capacity	Number of Riders**
Rockport/Ipswich	5	26	2,780	2,227
Haverhill/Reading	4	20	2,140	1,627
Lowell	3	16	1,710	1,481
Gardner/Fitchburg	3	16	1,710	886
Framingham	3	21	2,250	1,755
Needham	3	16	1,710	1,503
Franklin	3	22	2,400	2,720
Attleboro/Stoughton	5	36	3,600	4,284
Fairmont/Readville	3	9	1,000	726
TOTAL	32	182	19,300	17,209

Source: MBTA.
* Trains departing between 4:30 PM and 5:55 PM.
** Passenger counts during October 1989.

- Route 111 (Woodlawn - Haymarket Station)
- Route 325 Express (Elm Street - Haymarket Station)
- Route 326 Express (West Medford - Haymarket Station)
- Route 352 Express (Burlington - Boston)
- Route 353 Express (Burlington Industrial Area - Boston)
- Route 354 Express (Woburn - Boston)
- Route 400 Express (Lynn - Boston via GE Bridge)
- Route 426 Express (Saugus - Haymarket Station)
- Route 440 Express (Lynn - Boston via Western Avenue)
- Route 441 Express (Central Square - Marblehead via Paradise)
- Route 442 Express (Central Square - Marblehead via Humphrey)
- Route 450 Express (Salem - Boston)

- Route 455 Express (Salem - Lynn via Loring)

The typical bus used on these routes has a seating capacity of 40 passengers. Its normal carrying capacity (used for service planning) is 60 passengers, although greater loads can be accommodated under crush conditions. Based on the scheduled headways, these bus routes have a total planning capacity of 5,050 passengers per direction in the evening peak hour. Table IV-A-16 shows the bus routes, headways, and planning capacity.

Pedestrians

The existing sidewalks adjacent to Boston Garden/North Station consist of both minor and major pedestrian corridors. Inventories of sidewalk characteristics and pedestrian volumes were compiled as part of the data collection process. In accordance with the BRA and MEPA scopes, level-of-service analyses for walkways and crosswalks were conducted under 1990 Existing conditions at ten study area locations for morning and evening commuter peak hours and for the pre-event peak hour.

Pedestrian Network Description

Pedestrian access to Boston Garden/North Station is currently provided from the north and south. From the north, pedestrians enter Boston Garden by means of a pedestrian pathway between Nashua Street and the rear entrance. From the south, which is the primary entrance to Boston Garden, pedestrians enter through one of the two main entrances on Causeway Street or through the Boston Garden Sports Cafe which has a separate entrance. Boston Garden staff and arena performers can also access Boston Garden directly by means of a walkway which connects Boston Garden to the second floor of 150 Causeway Street, but this entrance is not open to the public.

Table IV-A-16 MBTA BUS ROUTES SERVING NORTH STATION AREA - EVENING PEAK HOUR

Route	Destination	Headway* (Minutes)	Planning Capacity**
6	South Boston	30	120
92	Assembly Square	13	280
93	Sullivan Station	7	510
111	Woodlawn	6	600
325***	Elm Street	12	300
326***	West Medford	15	240
352***	Burlington	10	360
353***	Burlington Industrial Area	30	120
354***	Woburn	10	360
400***	Lynn	15	240
426***	Saugus	10	360
440***	Lynn	10	360
441***	Marblehead	10	360
442***	Marblehead	15	240
450***	Salem	10	360
455***	Salem	15	240
	TOTAL		5,050

* Spring 1990 schedule.
** Planning capacity is 60 passengers per bus.
*** Express service.

Corridors and sidewalks in the area that provide direct access to the site include the following:

- Causeway Street - A major pedestrian corridor along the south edge of the site providing access to Boston Garden from the North End, Beacon Hill, and Bulfinch Triangle. Causeway Street is a median-divided roadway with sidewalks on both sides. The elevated MBTA Green Line is located over Causeway Street. The MBTA Green and Orange Line station entrances are located on the south side of Causeway Street between Canal and Haverhill

Streets. Heavy traffic volumes along Causeway Street make pedestrian crossing difficult. This is especially critical at Canal Street where pedestrian volumes are heaviest and there is no pedestrian signal to stop Causeway Street traffic. At times when pedestrian volumes are very high, as they are, for example, before a Boston Garden event, pedestrians simply take over the street, forcing traffic to wait for gaps in the pedestrian flow. Pedestrians also encounter many obstacles along the sidewalks on Causeway Street from the columns which support the overhead Green Line tracks. The columns of the elevated Green Line block daylight and lines of sight. As a result of these factors, the pedestrian environment along Causeway Street is not very attractive and gives some pedestrians a perception of crowded, unpleasant, and unsafe conditions.

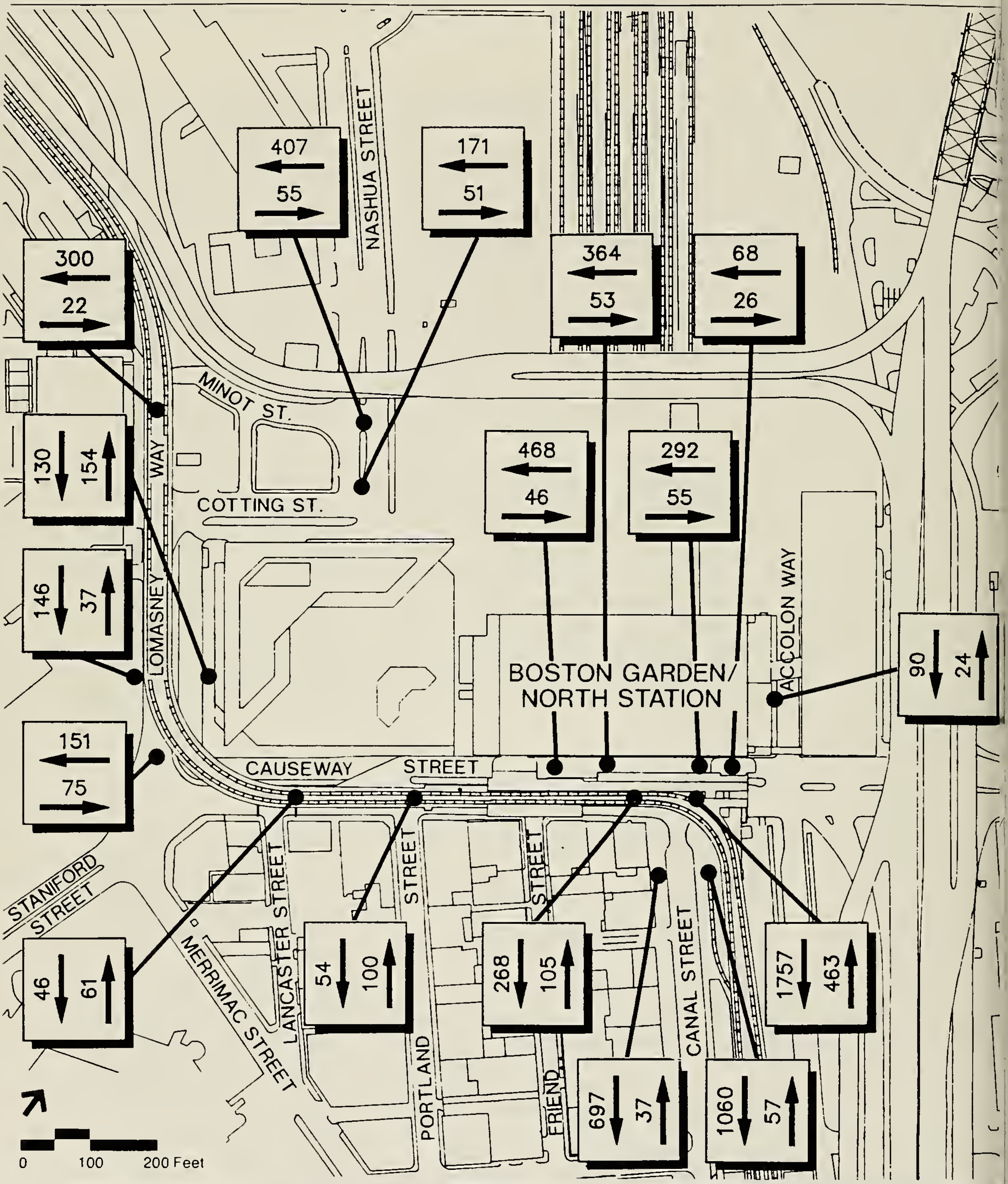
- Canal Street and Friend Street - These pedestrian corridors run north to south and connect the site with Government Center and Quincy Market.

- Nashua Street - This roadway provides pedestrian access from north of Boston Garden primarily from parking facilities located along Nashua Street. In peak commuter hours, this street provides pedestrian access to Beacon Hill, the Massachusetts General Hospital, the Spaulding Rehabilitation Center, and the Registry of Motor Vehicles from the commuter rail station. Minot and Cotting streets provide connections between Nashua Street and Lomasney Way. Pedestrians use these streets to access the Massachusetts General Hospital parking facility. There is no clearly defined pedestrian path and, as a result, pedestrians cross these streets and Nashua Street in random locations. Planned roadway improvements in this area will provide a more controlled and defined pedestrian crossing in the future.

Pedestrian Volumes

Pedestrian volumes were observed in the project area during March, May, and June of 1990. The counts focused on the level of pedestrian activity at locations identified for analysis in the scoping determinations issued by the BRA and MEPA. Counts were taken during the morning commuter peak period (7:30 AM to 9:30 AM) and during the evening commuter peak period through the pre-event peak period (4:00 PM to 8:00 PM) on both event and non-event nights.

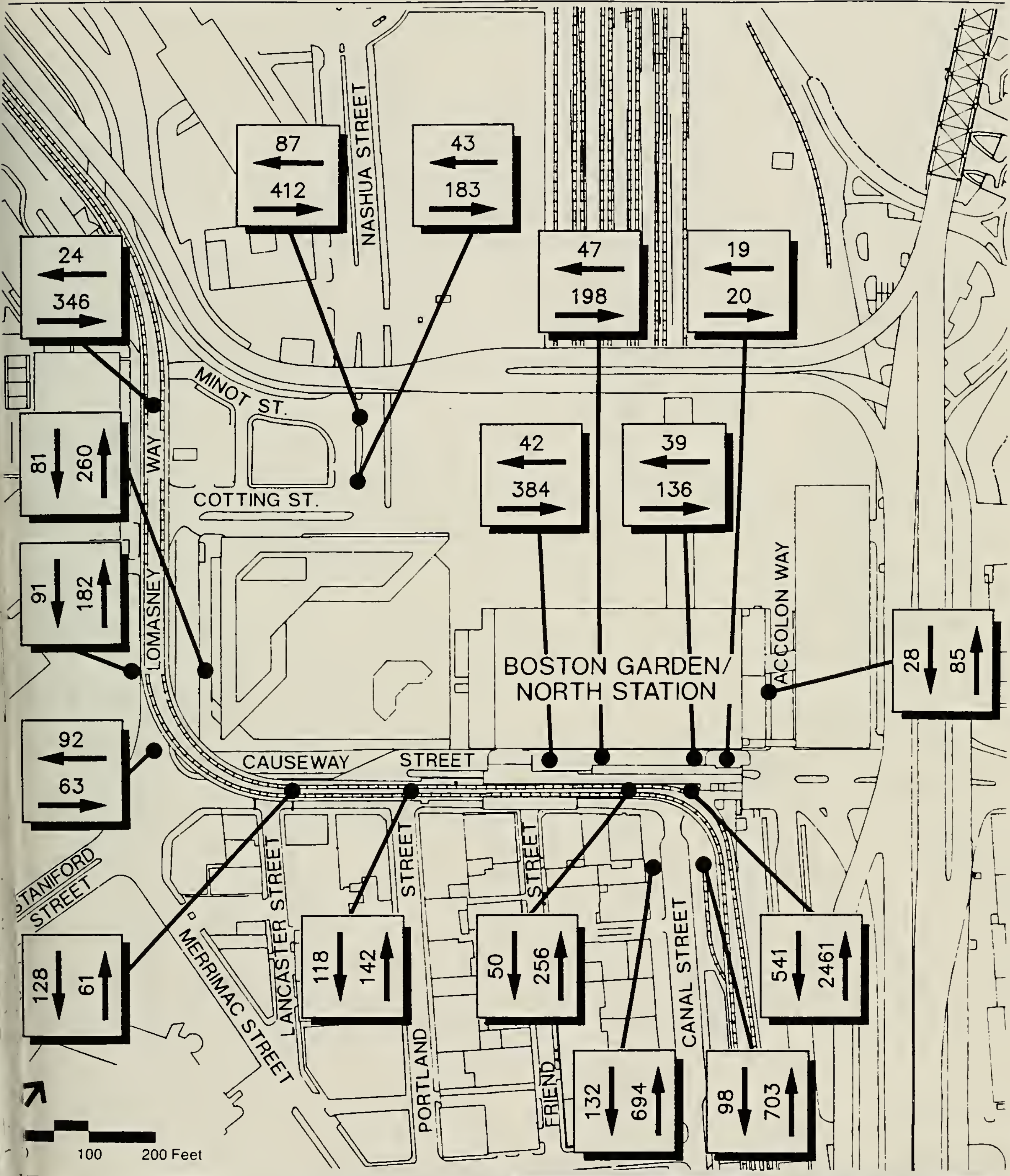
Existing peak hour pedestrian volumes are shown in Figures IV-A-8, IV-A-9, IV-A-10, and IV-A-11 for four conditions: the morning commuter peak hour, the evening commuter peak hour on a non-event night, the evening commuter peak hour on an event night, and the pre-event peak hour, respectively. It should be noted that street crossing counts along Causeway Street represent pedestrian volumes crossing the entire length of the street and are not limited to crosswalks. For presentation and analysis purposes, the volumes were assigned to the nearest crosswalk. As one might expect, comparison of the evening commuter peak hours on event and non-event nights shows that pedestrian volumes were significantly higher on an event night on walkways adjacent to Boston Garden and crossing Causeway Street in front of Boston Garden. For this reason, the volumes observed during the evening commuter peak hour on an event night were used for analysis of the evening commuter peak hour.



Vanasse Hangen Brustlin, Inc.

Existing Morning
Commuter Peak Hour
Pedestrian Volumes

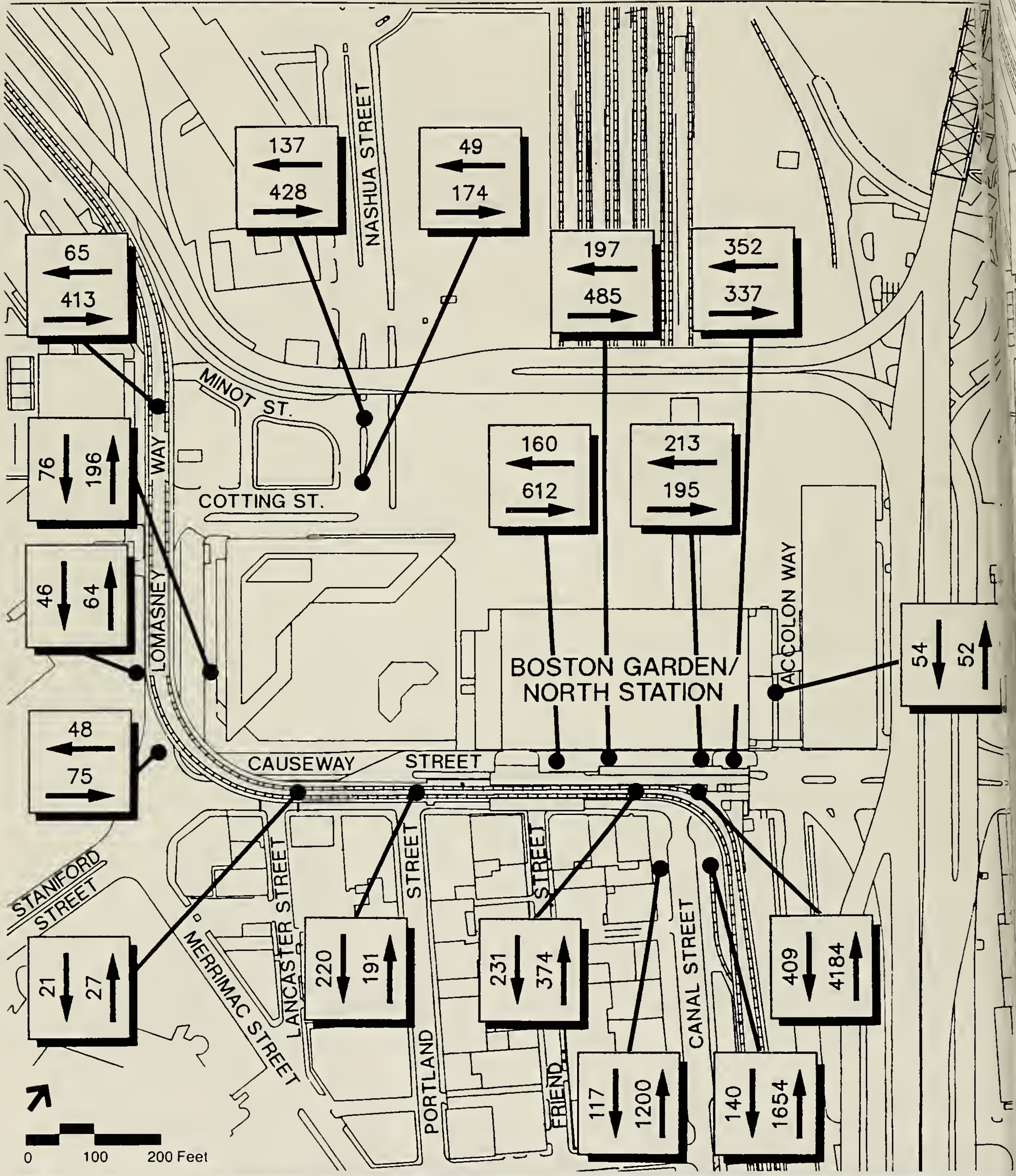
Figure IV-A-8



Vanasse Hangen Brustlin, Inc.

Existing Evening
Commuter Peak Hour
(Non-Event Night)
Pedestrian Volumes

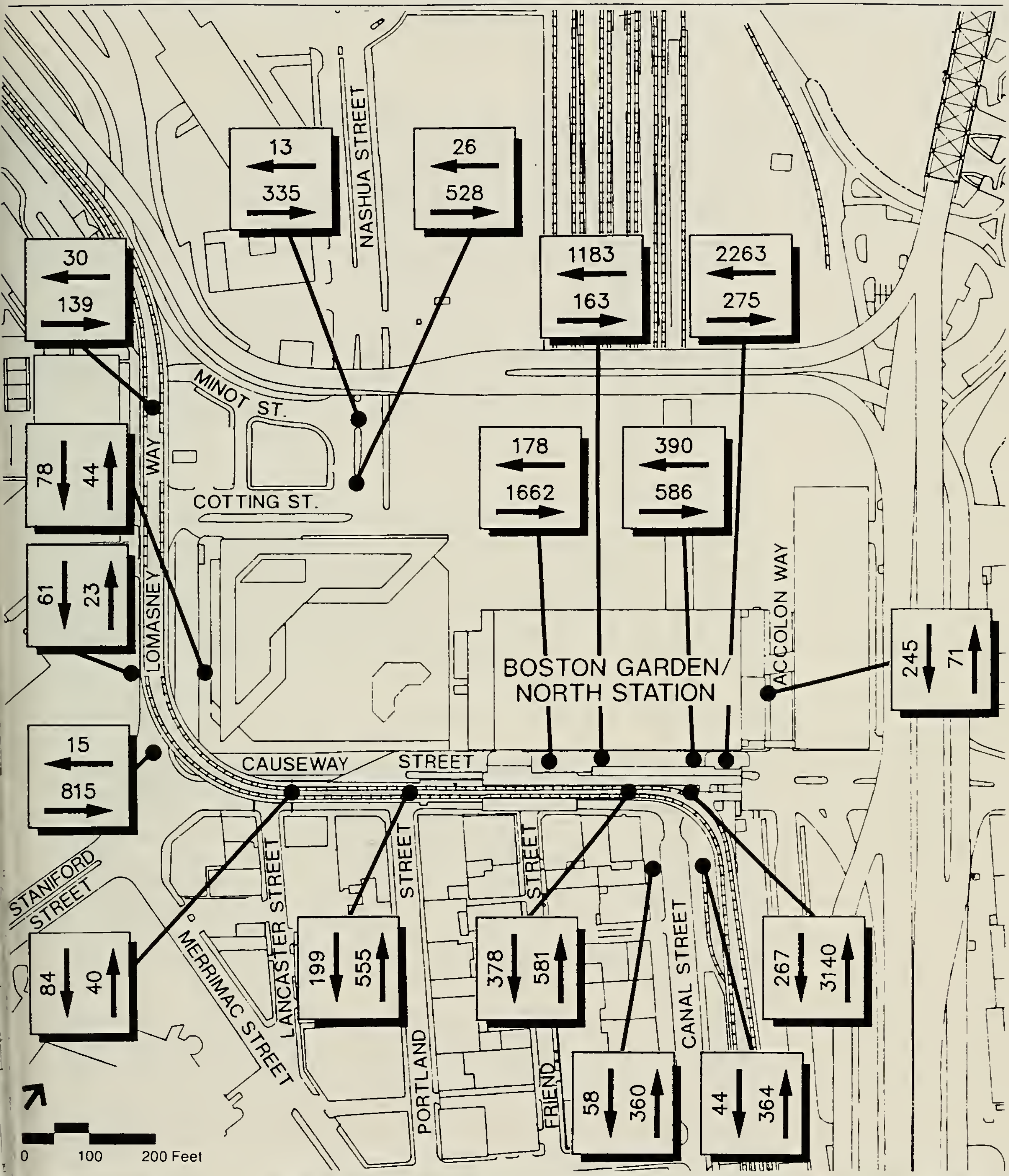
Figure IV-A-9



Vanasse Hangen Brustlin, Inc.

Existing Evening
Commuter Peak Hour
(Event Night)
Pedestrian Volumes

Figure IV-A-10



Vanasse Hangen Brustlin, Inc.

Existing
Pre-Event Peak Hour
Pedestrian Volumes

Figure IV-A-11

In general, areas of high pedestrian activity during both the morning and evening commuter peak hours were on sidewalks in front of Boston Garden and crosswalks on Causeway Street at Canal Street and Friend Street. Other areas of high pedestrian activity during the commuter peak hours occurred along Canal Street and behind Boston Garden crossing Nashua Street. These latter volumes are high due to the location of the Massachusetts General Hospital remote parking facility on Nashua Street.

During the morning commuter peak hour, the predominant pedestrian flows were observed to be in the direction away from Boston Garden. This is due to the location of the commuter rail terminal in North Station. During the evening commuter peak hour and the pre-event peak hour, the predominant direction of pedestrian flow was observed to be towards Boston Garden, as would be expected for the pre-event peak hour due to the location of the commuter rail station and Boston Garden itself.

During the pre-event peak pedestrian hour, which occurred between 6:30 PM and 7:30 PM in the area, pedestrian activity was highest on sidewalks adjacent to Boston Garden and across Causeway Street, the same locations which are highest during the evening commuter peak hour. In addition to these areas, pedestrian activity was high along Cotting Street towards the rear entrance to Boston Garden and crossing Lomasney Way at Causeway Street in the direction of Boston Garden. The pre-event peak hour volumes were generally higher than the observed evening commuter peak hour pedestrian volumes.

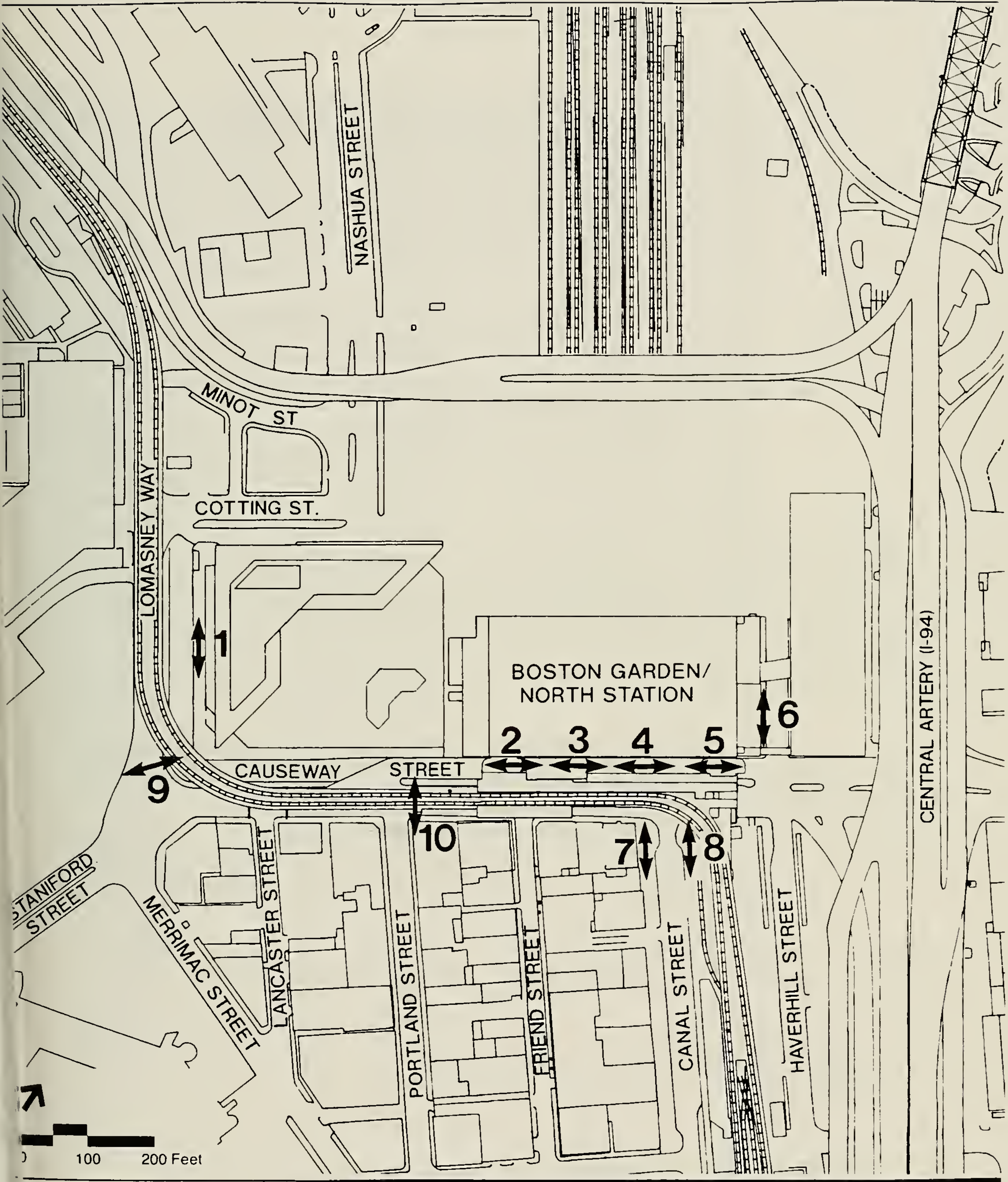
Pedestrian Level-of-Service Analysis

Level-of-service analyses were conducted for eight walkway locations and two crosswalk locations in the study area. The walkways that were analyzed are those adjacent to Boston Garden along Causeway Street and Accolon Way, the east side of Lomasney Way, and both sides of Canal Street. Because no method of analysis has been developed for crosswalks at unsignalized intersections, the crosswalks that were analyzed are those located at signalized intersections at Causeway Street and Portland Street, and Merrimac Street, Lomasney Way, Causeway Street, and Staniford Street. Figure IV-A-12 shows the locations where pedestrian analyses were conducted. The analysis procedures used and level-of-service results are discussed below.

Although pedestrian volumes north of the site along Cotting Street and crossing Nashua Street were observed, no formal analysis was done because the observed pedestrian movements did not follow an orderly pattern that allowed for formal analysis. Under future conditions, the pedestrian environment north of the site will be greatly improved in terms of Boston Garden access and pedestrian safety. A formal analysis of future pedestrian level of service in this area is included in the Probable Project Impacts section.

Walkway and Crosswalk Analysis Procedures

The 1985 Highway Capacity Manual defines a walkway analysis procedure for calculating pedestrian level of service based on the pedestrian flow rate in pedestrians per minute per foot of effective sidewalk width. A rating system from LOS A to F is provided for walkways. Within a walkway, the highest



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Existing Pedestrian Analysis Locations

Figure IV-A-12

level of service, LOS A, affords pedestrians the opportunity to move in desired paths without altering movements in response to other pedestrians. At LOS B, pedestrians become aware of other pedestrians and may alter their walking paths. At LOS C, sufficient space is available to select normal walking speeds and bypass other pedestrians in primarily one-way streams. At LOS D, the selection of individual walking speeds becomes restricted, as does the ability to bypass other pedestrians. LOS E and F are the lowest levels of service and are characterized by frequent, unavoidable contact with other pedestrians.

Pedestrian flow is subject to wide variability on a minute-by-minute basis. General flows of pedestrians, as well as the effects of "platooning" of pedestrians, must be considered. A platoon is created when pedestrians move together as a group from a stopped position. Pedestrians commonly form platoons while waiting to cross a street at a signalized intersection. Transit facilities can also create surges in demand by generating large groups of pedestrians in short time intervals, followed by time periods during which little or no flow occurs. Until they disperse, pedestrians within these types of groups move together as a platoon. Platoons can also form if passing is impeded due to insufficient space and faster pedestrians are forced to slow down behind slower walkers.

Due to the presence of transit stations near the project site and the presence of traffic signals at nearby intersections, both the general flow and the platoon effect of pedestrians were analyzed on study area sidewalks. Table IV-A-17 provides a summary of pedestrian level-of-service criteria for walkways.

The methodology for determining walkway level of service involves the following steps:

- Calculate the effective walkway width (areas of the sidewalk with obstacles such as light poles or trees) by subtracting any unusable width from the total walkway width.

- Calculate the pedestrian unit flow rate in pedestrians per minute per foot of effective sidewalk width. This flow rate is calculated by dividing the total two-way 15-minute pedestrian volume by 15 minutes and then dividing by the effective width of the walkway.

- Calculate pedestrian flow rate under platoon conditions. The pedestrian rate of flow under platoon conditions is calculated by adding 4.0 to the average pedestrian flow rate.

The results are compared to the level-of-service criteria to determine pedestrian level of service.

Table IV-A-17

PEDESTRIAN WALKWAY AND CROSSWALK LEVEL OF SERVICE CRITERIA

Level of Service	Crosswalk Space*	Walkway Flow Rate**
A	≥ 130	≤ 2
B	≥ 40	≤ 7
C	≥ 24	≤ 10
D	≥ 15	≤ 15
E	≥ 6	≤ 25
F	Less than 6	Variable

Source: Highway Capacity Manual, Special Report 209; Transportation Research Board; Washington, DC (1985).

* Square feet per pedestrian.

** Pedestrians per minute per foot.

Analysis of pedestrian flow characteristics in crosswalks is similar to that used in the walkway analysis. The level-of-service concepts developed for pedestrian movement on walkways are also applied to the crosswalk analysis by calculating the average circulation space per pedestrian. Traffic signals and turning vehicles, however, also affect pedestrian flow in crosswalks and are considered in the analysis. Traffic signals alter pedestrian movement in crosswalks by forcing pedestrians into denser platoons, which affects the distribution of normal walking speeds for pedestrians. Level-of-service criteria for crosswalks are presented in Table IV-A-17.

Along with the average circulation space per pedestrian, a surge condition was analyzed. The surge condition relates to the maximum flow of pedestrians during a walk phase. It occurs when two lead platoons from opposite corners cross simultaneously when the walk phase is illuminated. This surge can temporarily force pedestrians out of the crosswalks and closer to the traffic flow.

The methodology for determining crosswalk level of service involves the following steps:

- Determine the total available time-space in the crosswalk. This is equal to the product of the crosswalk area and the time pedestrians are allowed to cross the street.
- Determine average crossing time. The average time a pedestrian occupies a crosswalk is obtained by dividing the length of the crosswalk by the assumed walking speed. Average walking speed in crosswalks is assumed to be 4.5 feet per second.
- Determine the total crosswalk occupancy time. The total crosswalk occupancy time is the product of the average crossing time and the number of pedestrians using the crosswalk during one signal cycle.

- Determine the average circulation space per pedestrian and the average level of service. The average circulation space provided for each pedestrian is determined by dividing the time-space available for crossing by the total occupancy time. This result is used to determine the level of service under average conditions.

- Determine the level of service for the maximum surge condition. This is calculated by dividing the area of the crosswalk by the maximum number of pedestrians in the crosswalk. This result is used to determine the level of service under maximum surge conditions.

Walkway and Crosswalk Level-of-Service Summary

Using the procedures described above, walkway and crosswalk level-of-service analyses were conducted for walkways and crosswalks adjacent to the site at ten locations during the morning and evening commuter peak hours and during the pre-event peak hour. The results of these analyses are presented in Tables IV-A-18 and IV-A-19 for walkways and crosswalks, respectively.

Under Existing conditions, all study area sidewalks and crosswalks operate at level-of-service B or better under average conditions for all peak hours. For the platoon and surge conditions, all locations operate at level-of-service C or better for all peak hours, except the west side of Canal Street, which operates at LOS D during the evening peak hour.

As shown earlier in the pedestrian volume networks, one location with very high pedestrian volume was across Causeway Street at Canal Street. This is an unsignalized intersection where pedestrians are forced to cross Causeway Street during a break in traffic. Due to the high traffic and pedestrian volumes at this location, frequent pedestrian-traffic conflicts occur resulting in an undesirable and unsafe condition. Although no formal analysis procedure is available for this unsignalized location, its pedestrian level of service could be considered unacceptable. In the future, pedestrian activity will decrease at this location due to the new MBTA Orange and Green Line entrances within the project site. Further, the improvements suggested for Causeway Street in the mitigation plan, presented later in this chapter, include an improved pedestrian plan for this intersection.

Loading

Two types of loading activities occur at the existing Boston Garden: concession supply loading and event equipment changeover. Concession supply activity occurs in two locations. Large truck deliveries are received by way of the 150 Causeway Street ramp, and small delivery vehicles load and unload at the south end of Accolon Way. Concession loading occurs between 7:00 AM and 4:00 PM every day.

All event equipment changeover loading activities currently take place via a ramp which extends from the parking area behind 150 Causeway Street to the second level of that building. A walkway which connects the second level of 150 Causeway Street to Boston Garden is used to bring materials to and from Boston Garden. The time of day during which changeovers occur varies for different events. In general, inbound (event setup) activity occurs on the day of the event, usually during the morning hours, but sometimes extending into the early afternoon. Outbound (event breakdown) activity typically occurs right after the end of an event. As an example, concert loading activity normally occurs from late at night to the early morning hours following an event. No external loading activities occur during changeovers of sports events because the equipment is stored inside Boston Garden or at 150 Causeway Street.

Table IV-A-18 EXISTING PEDESTRIAN WALKWAY LEVEL-OF-SERVICE

Sidewalk	Location Designation*	Period	Average Condition Flow Rate**	Average Condition LOS***	Platoon Condition+ Flow Rate	Platoon Condition+ LOS
Lomasney - east side (between Cotting and Causeway)	1	Morning	0.4	A	4.4	B
		Evening	0.4	A	4.4	B
		Pre-Event	0.2	A	4.2	B
Causeway - north side (west of entrance)	2	Morning	1.2	A	5.2	B
		Evening	1.5	A	5.5	B
		Pre-Event	5.0	B	9.0	C
Causeway - north side (between west Boston Garden entrance and restaurant)	3	Morning	0.8	A	4.8	B
		Evening	1.4	A	5.4	B
		Pre-Event	3.0	B	7.0	B
Causeway - north side (between restaurant and east Boston Garden entrance)	4	Morning	0.7	A	4.7	B
		Evening	0.9	A	4.9	B
		Pre-Event	2.0	A	6.0	B
Causeway - north side (east of Boston Garden entrances)	5	Morning	0.2	A	4.2	B
		Evening	1.5	A	5.5	B
		Pre-Event	5.9	B	9.9	C
Accolon Way - west side	6	Morning	0.6	A	4.6	B
		Evening	0.6	A	4.6	B
		Pre-Event	1.8	A	5.8	B
Canal - west side (south of Causeway)	7	Morning	2.6	A	6.6	B
		Evening	6.3	B	10.3	D
		Pre-Event	1.9	A	5.9	B
Canal - east side (south of Causeway)	8	Morning	1.6	A	5.6	B
		Evening	3.5	B	7.5	C
		Pre-Event	0.7	A	4.7	B

* See Figure IV-A-12.
** Pedestrians per minute per foot.
*** Level of service.
+ Average flow rate + 4.0.

Table IV-A-19 EXISTING PEDESTRIAN CROSSWALK LEVEL-OF-SERVICE

Sidewalk	Location Designation*	Period	Average Condition Space**	Average Condition LOS***	Surge Condition+ Space	Surge Condition+ LOS
Lomasney at Causeway	9	Morning	306	A	128	B
		Evening	577	A	256	A
		Pre-Event	87	B	38	C
Causeway at Portland (east side)	10	Morning	227	A	207	A
		Evening	112	B	90	B
		Pre-Event	61	B	49	B

* See Figure IV-A-12.
** Square feet per pedestrian.
*** Level of service.

During many Boston Garden events, the right lane of westbound Causeway Street is occupied by broadcast media trucks. These trucks impede vehicular and pedestrian flow and may affect safety. The New Boston Garden Development will provide off-street space to accommodate the media vehicles.

PROBABLE PROJECT IMPACTS

To assess the impacts of the proposed New Boston Garden Development on the transportation system within the study area, separate travel demand projections were made for each proposed land use and trip purpose or type (work or non-work). Projected trips were then distributed to the various transportation networks--roadway, transit, and pedestrian. Project impacts (Build conditions) were identified by comparison to future (1995 and 2000) conditions without the proposed development (No-Build). The two No-Build conditions (1995 and 2000) do not include any part of the project. The 1995 Build program includes the new arena, Building C, and the Public Concourse. Selected analyses were also conducted to isolate the impacts of the arena in 1995. The 2000 Build program expands on the 1995 Build program by adding Buildings A and B.

Project Travel Demand

Project travel demands were forecast based on the building program shown in Tables IV-A-1 and IV-A-2 presented in the Introduction to this chapter. Trips by mode of travel were calculated on a daily basis and for the morning and evening commuter peak hours. Although the arena component of the project will generate the largest number of trips in the hour before an event and the hour after an event, analysis of those hours was not necessary. This is because existing traffic, transit, and pedestrian counts around Boston Garden show that, even when an event is scheduled for 7:35 PM, overall demand on the transportation system is highest during the evening commuter peak hour (5:00 to 6:00 PM). Further, trips generated by the commercial component of the project are greatest during commuter peak hours.

Increased travel demands for the arena portion of the development were forecast based on increased seating capacity of the New Boston Garden. The results of surveys at two Boston Garden sports events were used to determine existing travel characteristics of Boston Garden patrons. The resulting trip generation rates, mode splits, and percentage traveling in the commuter peak hour were applied to the increased seating to determine net additional arena trips.

Future travel demands for the commercial component of the project were forecast using daily person-trip generation rates for the proposed new office and retail uses by type of trip (work and non-work). Travel mode (vehicle, transit, or walk) percentages, vehicle occupancy rates (average number of persons per vehicle), and peak hour factors (the percentage of total tripmaking occurring during each peak hour) were then applied to the resulting person trips to derive peak hour trips by mode.

The results of surveys conducted in 1987 and 1988 at three office buildings in the nearby Bulfinch Triangle area were used to determine the travel characteristics of employees and visitors to and from office buildings in the North Station area. These travel characteristics were used to project the number of trips generated by future development at the site. Previous transportation studies conducted in downtown Boston were also used to project retail trip generation characteristics.

Arena Trip Generation

The arena event trip generation used in the impact analysis was based on the number of trips generated by a sold-out basketball game held on a weekday evening. A basketball game was used as the analysis event because it has a relatively large attendance and frequently occurs on weekday evenings when it can impact the critical evening commuter peak hour.

Basketball games will have a relatively large seating capacity of almost 18,400 compared to the maximum arena capacity of 19,500. The only events which are larger are wrestling and boxing matches, some center stage concerts (concerts where the stage is located in the center of the arena floor), and exhibition tennis matches. All other events, including hockey games, other concerts, and family shows, have lower seating capacity. Basketball also has a larger increase in seating capacity than other events such as hockey. In addition, basketball games are regularly sold out, whereas other events often have some unsold seats.

The second reason for using a basketball game as the analysis event is that team sport events (including hockey) occur fairly frequently on weekday evenings, when arena events contribute some traffic to the evening commuter peak hour. More than sixty professional team sport events (including playoff games) occured on weekday nights during the 1989-1990 season. Events with greater seating capacity than the event analyzed occurred on only a few weekdays.

Trip generation for the New Boston Garden was calculated by applying travel characteristics for a basketball game to the approximately 3,500 additional seats that will be available for basketball events. Basketball travel characteristics were based on a survey of patrons conducted at a regular season basketball game in April 1990. The results of the basketball survey and a similar hockey survey are summarized below.

Arena Patron Survey Results. Information on the travel characteristics of Boston Garden patrons was obtained for the two most typical weekday events, a Boston Bruins evening hockey game and a Boston Celtics evening basketball game, both scheduled for 7:35 PM start times. Questionnaire surveys were conducted at a Bruins versus Hartford Whalers playoff game (April 17, 1990) and a Celtics versus Miami Heat regular season game (April 12, 1990). Survey results were used to estimate existing trip patterns and to project additional vehicle trips resulting from the arena expansion.

Results were obtained for three categories of seating: general seating for hockey, general seating for basketball, and skybox seating for basketball. The two general seating categories represent all responses received, including responses from skybox patrons. The third category includes only the responses received from the skybox seats during the Celtics game. A summary of key survey results for each of the three data categories is presented in Table IV-A-20 and in the following paragraphs.

Table IV-A-20 BOSTON GARDEN PATRON SURVEY RESULTS

	General Seating*		Skybox Seating
	Hockey	Basketball	Basketball
Number of Seats	14,442	14,890	440
Percent Arriving During Evening Peak Hour (5:00 to 6:00 PM)	19.5%	14.3%	13.2%
Travel Mode to Downtown**:			
Automobile***	73.8%	69.5%	83.3%
Public Transportation+	25.5%	28.8%	14.2%
Walk	0.7%	1.8%	2.6%
Average Vehicle Occupancy to Downtown	2.38%	2.40%	2.25%
Travel Mode Leaving Boston Garden**:			
Automobile***	75.6%	681.%	86.8%
Public Transportation+	23.6%	28.9%	11.8%
Walk	0.9%	3.0%	1.3%
Average Vehicle Occupancy Leaving Garden	2.44%	2.57%	2.37%
Evening Peak Hour Vehicle-Trip Generation Rate++:			
In	6.1%	4.1%	4.9%
Out	0.1%	0.2%	0.3%
TOTAL	6.2%	4.3%	5.2%
Parking Demand+++	30	28	35

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* Based on all seats, including skybox seats.
** Due to rounding, percentages may not add up to 100 percent.
*** Includes riders who were dropped off or picked up by a vehicle not parked in the area.
+ Includes chartered bus.
++ Vehicle trips per 100 seats.
+++ Parking spaces per 100 seats.

Based on the arena patron survey results, travel characteristics for the expanded premium seating in the new arena were derived from the characteristics of existing skybox seat patrons. Trip generation rates for the expanded general type seats were derived from existing travel characteristics of general seating patrons. The arena component trip generation rates per 100 seats are presented in Table IV-A-21. They are based on the assumption that all seats are occupied and were calculated by applying the mode shares, VORs, and peak hour percentages from the arena patrons survey results.

Table IV-A-21 ARENA TRIP GENERATION RATES

	Vehicle*		Transit**		Walk**	
	Premium Seats	General Seats	Premium Seats	General Seats	Premium Seats	General Seats
Daily						
In	40.0	30.0	12.9	26.8	2.6	1.8
Out	40.0	30.0	9.2	26.9	1.3	3.0
TOTAL	80.0	60.0	22.1	53.7	3.9	4.8
Evening Peak Hour***						
In	4.9	4.1	1.7	3.8	0.3	0.3
Out	0.3	0.2	0.0	0.0	0.0	0.0
TOTAL	5.2	4.3	1.7	3.8	0.3	0.3

* Vehicle trips per 100 seats.
** Person trips per 100 seats.
*** 5:00 to 6:00 PM.

It should be noted that a small percentage of survey respondents (about 6 percent) indicated that they arrived downtown during the morning peak hour. These represent people who go to a Boston Garden event directly from work. The morning trip to work is a trip they would make even if they were not attending a Garden event. For this reason, the arena component of the New Boston Garden Development is expected to have no impact on the morning peak hour transportation system and, therefore, no morning peak hour generation rates are included in the table.

As shown in the table, the arena is expected to generate 40 vehicle trips for every 100 patrons using premium seats and 30 vehicle trips for every 100 patrons in general seating. During the evening commuter peak hour, approximately five vehicles are expected to arrive for every 100 premium seat patrons and approximately four vehicles are expected for every 100 general seating patrons. Transit person trip rates are much lower for premium seats than for general seating. It should be noted that the outbound transit and walk trip rates are generally lower than inbound rates because some patrons who arrive by transit or walking depart by automobile.

To project the number of additional trips the new arena would generate, the travel demand characteristics detailed above were applied to the increased seating of the arena for a basketball game. The expected increase in seating capacity for basketball is 3,052 additional premium seats and 421 additional general seats. The resultant increases in trips by travel mode due to the increased arena seating capacity are displayed in Table IV-A-22. A sold-out basketball game is expected to attract almost 1,350 additional vehicles to the North Station area with the new arena. Approximately 170 of these would arrive during the evening peak hour. More than 500 additional people would use transit, with almost 70 of those arriving in the evening peak hour.

Table IV-A-22 **PROJECTED INCREASE IN ARENA TRIPS***

	Auto**	Transit***	Walk***
Daily:			
In	1,347	507	87
Out	1,347	394+	52+
TOTAL	2,694	901	139
Evening Peak Hour:			
In	167	68	12
Out	10	0	0
TOTAL	177	68	12

* Based on a sold-out basketball game with 3,052 additional premium seats and 421 additional general seats.
** Vehicle trips.
*** Person trips.
+ Outbound daily transit and walk trips are lower than inbound trips because some patrons who arrive by transit or walking depart by auto.

Commercial Component Trip Generation

Trip generation for the commercial component is calculated by applying person-trip rates, percentage by mode, vehicle occupancy rates, and peak hour percentages to the floor area for office and retail uses. The commercial component trip generation rates that were used are based primarily on building surveys and counts conducted in the Bulfinch Triangle area in 1987 and 1988. Three separate building surveys were conducted at 90 Canal Street, 225 Friend Street, and 200 Portland Street. These surveys and counts collected information about type of trips, total trips to and from the buildings, mode of travel, time of arrival and departure, origin and destination of trips, and number of people per vehicle.

The results of the three building surveys were combined to calculate trip generation factors for the commercial component of the proposed New Boston Garden Development. These surveys represent the best data available regarding travel characteristics in the North Station area. The resulting trip generation rates were applied to future conditions at the project because all three buildings surveyed contain recently rehabilitated high quality office space with a mix of tenants as might be expected in the New Boston Garden Development. Detailed results of the Bulfinch Triangle building surveys are presented in the Technical Data appendix. Because survey data about retail uses are very limited, some retail trip generation factors are based on those used in previous downtown Boston studies, including the Central Artery/Third Harbor Tunnel Draft SEIS/R and One Twenty Five High Street Transportation Assessment and Access Plan (1986).

The (24-hour weekday) daily person-trip generation rates for the office and retail uses in the commercial component of the project are shown in Table IV-A-23. Person-trip generation rates for the office and retail land uses have been classified as work and non-work. Work-related trips are defined as the daily commuting trips to and from the place of work. Non-work trips include all non-commuting trips made by employees and all trips make by visitors to the site.

Table IV-A-23 **DAILY PERSON-TRIP GENERATION RATES***

Use	Purpose	In	Out	Total
Office	Work**	3.39	3.39	6.78
	Non-Work**	5.19	5.19	10.38
	TOTAL	8.58	8.58	17.16
Retail	Work**	2.10	2.10	4.20
	Non-Work***	28.10	28.10	56.20
	TOTAL	30.20	30.20	60.40

* Person trips per 1,000 square feet.
** Based on results of office building surveys in the Bulfinch Triangle made by Vanasse Hangen Brustlin, Inc. in 1987 and 1988.
*** Detailed Travel Model Documentation, Central Artery/Third Harbor Tunnel Project, Draft Report; Bechtel/Parsons Brinckerhoff and Central Transportation Planning Staff (February 1990).

Table IV-A-24 presents the percentage of daily arrivals and departures expected to occur during the morning and evening peak hours. Different peak hour percentages have been applied based on the type of trip (work or non-work), land use, and mode of travel. The majority of trips occurring during the peak hours are work trips made by commuters.

Table IV-A-24 **PERCENTAGE OF DAILY TRIPS DURING PEAK HOURS**

		Work		Non-Work	
Use	Direction	Morning Peak	Evening Peak	Morning Peak	Evening Peak
Office*	In	50%	0%	17%	8%
	Out	0%	42%	3%	14%
Retail**	In	10%	10%	1%	5%
	Out	1%	20%	1%	10%

* Bulfinch Triangle office buildings surveys.
** One Twenty Five High Street Transportation Assessment & Access Plan (1986).

Table IV-A-25 shows the percentage of total travel expected to be made by each travel mode--automobile, transit, and walk. The mode split percentages for the office non-work trips are taken from the results of the surveys of office buildings in the Bulfinch Triangle area. Retail mode split percentages are the same used in previous analyses of downtown developments.

Table IV-A-25 **MODE SHARE PERCENTAGES**

		Travel Mode		
Use	Purpose	Auto	Transit	Walk
Office	Work*	29.0%	66.0%	5.0%
	Non-Work*	27.0%	30.0%	43.0%
Retail	Work*	29.0%	66.0%	5.0%
	Non-Work**	27.5%	32.5%	40.0%

* Bulfinch Triangle office buildings surveys.
** One Twenty Five High Street Transportation Assessment & Access Plan (1986).

Vehicle occupancy rates (VOR) describe the average number of persons per vehicle. These rates are divided into the number of person trips by automobile to derive the number of vehicle trips generated by the site. The rates shown in Table IV-A-26 are derived from the Bulfinch Triangle surveys with the exception of the retail non-work VOR which was derived from previous downtown area development analyses.

Table IV-A-26 **EXISTING VEHICLE OCCUPANCY RATES**

Use	Purpose	VOR
Office	Work*	1.4
	Non-Work*	1.3
Retail	Work*	1.4
	Non-Work**	1.9

* Bulfinch Triangle office building surveys.
** One Twenty Five High Street Transportation Assessment & Access Plan (1986).

The vehicle occupancy rates presented above were modified based on projected 1995 and 2000 areawide parking conditions described in detail in the Parking section presented later. In both 1995 and 2000, areawide parking demand is expected to exceed supply. This is due to the existing high level of utilization, the loss of spaces due to Central Artery reconstruction, and increased demand. As a result, the parking supply in the North Station area would not support the parking demand that would be generated if current travel behavior continued.

Travel demand characteristics can be expected to change under constrained parking conditions. In particular, transit mode share and vehicle occupancy typically increase as commuters are forced to reduce the number of vehicles brought into the area. Because the auto mode share in the area is already relatively low (29 percent), little additional shift to transit is expected. More likely an increase in vehicle occupancy rate can be expected. The current rate of 1.4 is considerably below that found is other areas of downtown (up to 1.8 in some buildings). where parking prices are higher and space availability is lower Person-trip generation rates and the percent of daily in and out trips during peak hours are not expected to change under constrained parking conditions.

Table IV-A-27 presents the vehicle occupancy rates anticipated under constrained parking conditions. As shown, only work trip vehicle occupancy rates are expected to change, increasing from 1.4 to 1.5 people per vehicle. Travel characteristics associated with non-work trips are not expected to change due to a parking constraint. The modified vehicle occupancy rates were calculated by assuming that the vehicle occupancy rates of all vehicles destined for the North Station area would increase to the extent necessary to bring parking demand into balance with the supply. The projected change in VOR represents an increase of approximately 7 percent.

Table IV-A-27 **PROJECTED VEHICLE OCCUPANCY RATES**

Use	Purpose	VOR
Office	Work	1.5
	Non-Work	1.3
Retail	Work	1.5
	Non-Work	1.9

The travel demand characteristics detailed above for the various land uses under constrained parking conditions were applied to the 1995 and 2000 Build programs of the New Boston Garden Development. Table IV-A-1 in the Introduction presented the 1995 and 2000 Build programs for the commercial component of the project. The resultant number of trips by travel mode and time period for the commercial component are displayed in Table IV-A-28.

The office and retail portion of the New Boston Garden Development will generate approximately 3,400 and 8,250 daily vehicle trips, respectively, in 1995 and 2000. Daily transit trips in 1995 and 2000 will be much higher, totaling approximately 7,500 and 18,100, respectively. In 1995, 392 morning peak hour and 355 evening peak hour vehicle trips are expected. By the year 2000, these will increase to 925 and 856, respectively.

Table IV-A-28 COMMERCIAL COMPONENT TRIPS - 1995 AND 2000

	1995		2000	
	Auto*	Transit**	Auto	Transit
Daily				
In	1,705	3,740	4,124	9,064
Out	1,705	3,740	4,124	9,064
TOTAL	3,410	7,480	8,248	18,128
Morning Peak Hour				
In	380	1,086	896	2,560
Out	12	3	29	11
TOTAL	392	1,089	925	2,571
Evening Peak Hour				
In	33	13	85	45
Out	322	922	771	2,200
TOTAL	355	935	856	2,245

* Vehicle trips.
** Person trips.

Total Project Travel Demand

Table IV-A-29 presents the total number of project trips (arena and commercial component) by travel mode and time period for 1995 and 2000. In 1995, the project will generate 533 vehicle trips and 1,003 transit trips in the evening peak hour. By 2000, evening peak hour trips will include 1,033 vehicle trips and 2,313 transit trips.

Table IV-A-29 **TOTAL PROJECT TRIPS - 1995 AND 2000**

	1995		2000	
	Auto*	Transit**	Auto	Transit
Daily				
In	3,052	4,247	5,471	9,571
Out	3,052	4,134	5,471	9,458
TOTAL	6,104	8,381	10,941	19,029
Morning Peak Hour				
In	380	1,086	896	2,560
Out	12	3	29	11
TOTAL	392	1,089	925	2,571
Evening Peak Hour				
In	200	81	252	113
Out	332	922	781	2,200
TOTAL	533	1,003	1,033	2,313

* Vehicle trips.
** Person trips.

Table IV-A-30 presents total vehicle trips by component of the proposed project. As shown, the arena component of the project generates about 45 percent of daily vehicle trips in 1995 and 25 percent in 2000. In the evening peak hour, the arena component generates 33 percent of the vehicle trips in 1995 and 17 percent of the vehicle trips in 2000. The arena component is expected to have no impact on the roadway network in the morning peak hour.

Table IV-A-30 PROJECT VEHICLE TRIPS BY COMPONENT

	1995			2000		
	Commercial	Arena	Total	Commercial	Arena	Total
Daily						
In	1,705	1,347	3,052	4,124	1,347	5,471
Out	1,705	1,347	3,052	4,124	1,347	5,471
TOTAL	3,410	2,694	6,104	8,248	2,694	10,942
Morning Peak Hour						
In	380	0	380	896	0	896
Out	12	0	12	29	0	29
TOTAL	392	0	392	925	0	925
Evening Peak Hour						
In	33	167	200	85	167	252
Out	322	10	332	771	10	781
TOTAL	356	177	533	856	177	1,033

Institute of Transportation Engineers Trip Generation Projections

Unadjusted Institute of Transportation Engineers (ITE) vehicle-trip estimates are presented in this section as required by MEPA Guidelines for Traffic Impact Analysis. Table IV-A-31 presents the ITE trip generation rates for each land use proposed for the commercial component of the New Boston Garden Development. Table IV-A-32 shows a comparison of the resulting 1995 and 2000 travel demands for the commercial component of the project using unadjusted ITE rates versus rates for the North Station area. It should be noted that ITE rates are based largely on information from suburban developments and assume that 100 percent of all trips made to a site are auto trips. As a result, there are no transit or walk trips generated using unadjusted ITE trip generation rates, making these rates inappropriate for calculating trip generation for an urban area, such as downtown Boston, which is served extensively by transit.

ITE arena trip generation rates are not presented in this analysis because the Trip Generation Manual does not present rates for an arena land use that is comparable to the type of arena and environment in which the New Boston Garden will be built. The closest land use to the proposed New Boston Garden that is presented in the Trip Generation Manual (Stadium - Code 450) presents results from only one study of a stadium located on significantly more acreage in a suburban area.

Table IV-A-31 UNADJUSTED ITE VEHICLE-TRIP GENERATION RATES*

	Office**	Retail***
Daily		
Work	5.02	18.94
Non-Work	3.14	75.77
TOTAL DAILY	8.16	94.71
Morning Peak Hour		
Work In	1.15	1.21
Non-Work In	0.15	0.41
Total In	1.30	1.62
Non-Work Out	0.00	0.47
Work Out	0.20	0.22
Total Out	0.20	0.69
TOTAL MORNING	1.50	2.31
Evening Peak Hour		
Work In	0.11	1.41
Non-Work In	0.11	2.84
Total In	0.22	4.25
Work Out	1.03	1.46
Non-Work Out	0.13	2.97
Total Out	1.16	4.43
TOTAL EVENING	1.38	8.68

Source: Trip Generation, Fourth Edition; Institute of Transportation Engineers (1987).

* Vehicle trips per 1,000 square feet.

** ITE Code 710.

*** ITE Code 820.

Table IV-A-32 COMMERCIAL COMPONENT TRIP GENERATION COMPARISON

	1995		2000	
Daily	ITE Rates	North Station Area Rates	ITE Rates	North Station Area Rates
In	4,400	1,705	11,548	4,124
Out	4,400	1,705	11,548	4,124
TOTAL	8,800	3,410	23,096	8,248
Morning Peak Hour				
In	1,260	380	3,006	896
Out	199	12	485	29
TOTAL	1,459	392	3,491	925
Evening Peak Hour				
In	255	33	708	85
Out	1,156	322	2,832	771
TOTAL	1,411	355	3,539	856

The use of unadjusted ITE trip generation rates results in a significantly larger number of vehicle trips for the commercial component of the project compared with the use of the rates developed from the building surveys in the North Station area. This difference is due to the fact that the ITE rates assume no transit use or walk trips. According to the Bulfinch Triangle surveys conducted for this Draft EIR/PIR, only approximately 30 percent of work trips are made by auto. In addition, suburban vehicle trips generally include a lower vehicle occupancy rate than that found in the Bulfinch Triangle surveys. For these reasons, ITE trip generation rates are not considered to be applicable to development in the North Station area and were, therefore, not used in the project travel demand analysis.

Estimation of No-Build Traffic Volumes

The previous section defined the project traffic generation for the 1995 Interim-Build and 2000 Full-Build scenarios. These volumes must be added to traffic flows expected on the No-Build highway networks in 1995 and 2000. Development of the No-Build traffic volume projections requires identifying road improvement projects expected to be completed by 1995 and 2000 as well as all other projects influencing the transportation system in those areas. Those projects are:

- Completion before 1995 of the Central Artery North Area (CANA) project, a rebuilding of the interchange of I-93 and US Route 1 in Charlestown

- Completion before 1995 of the Merrimac Street improvements, which will provide a widened Merrimac Street to carry two-way traffic flow between New Chardon Street and Lowell Square

- Completion before 1995 of the Nashua Street Connector, which will complement the Merrimac Street improvements by providing a smooth transition between Nashua Street and Lomasney Way

- Commencement before 1995 of construction activities related to the Central Artery/Tunnel (CA/T) project

- Closing of various parking facilities in the area (mainly due to Central Artery construction activity) and opening of the MBTA garage on the project site before 1995

- Growth in travel demand associated with other development projects expected to be completed before 1995

- Removal between 1995 and 2000 of the elevated Green Line on Causeway Street and Lomasney Way, making possible further improvements to roadway geometry and capacity

- Completion between 1995 and 2000 of the Central Artery/Tunnel (CA/T) project, resulting in dramatic changes to the volume and distribution of traffic

- Further growth in travel demand associated with other development projects expected to be completed between 1995 and 2000

The next two subsections explain the methods by which the 1995 and 2000 traffic volume projections were developed.

1995 Peak Hour Traffic Volumes

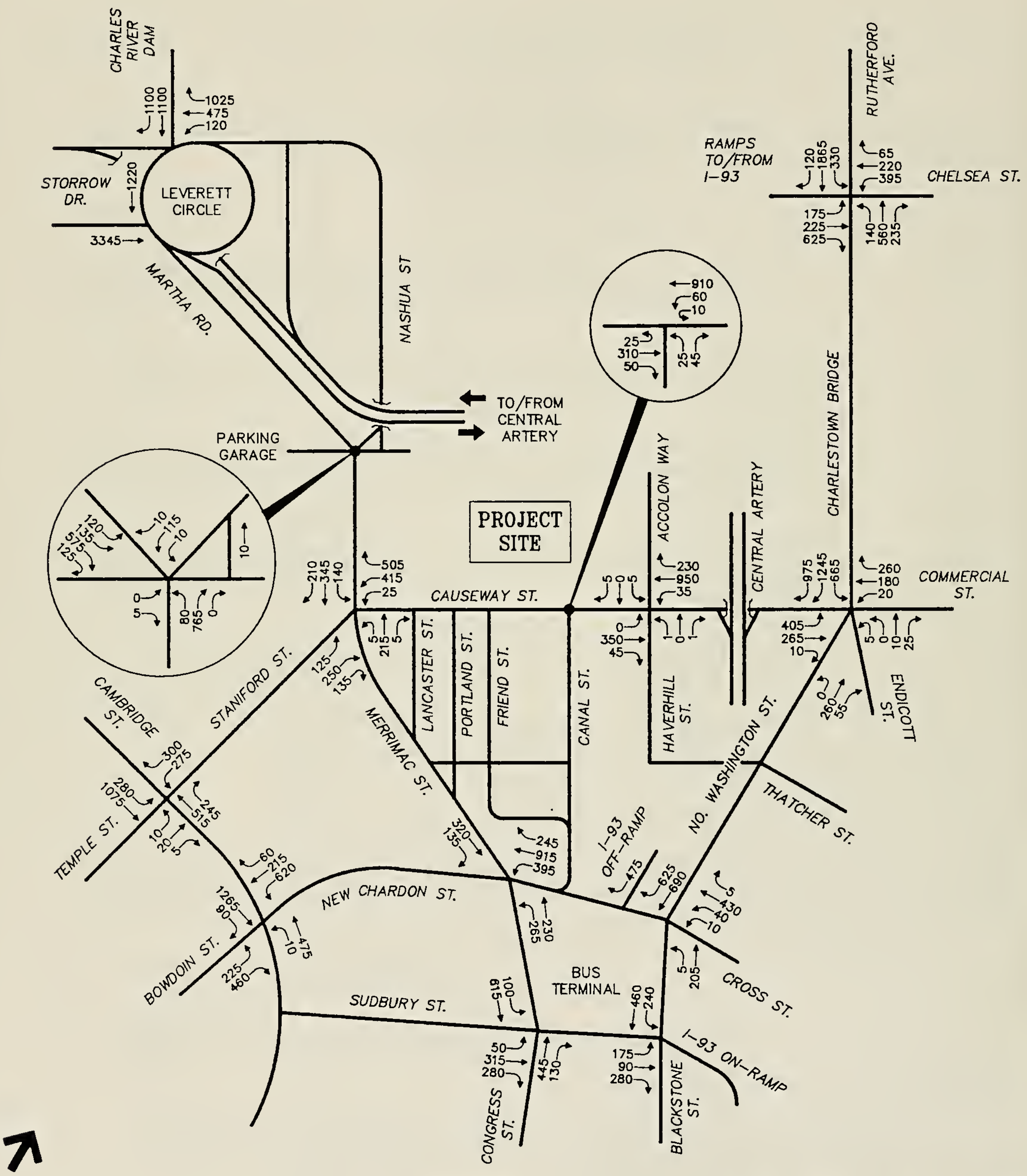
Figures IV-A-13 through IV-A-16 present 1995 No-Build and 1995 Interim-Build traffic volumes. As explained in detail below, these volumes were developed in four steps:

- Existing traffic volumes were first rerouted to reflect the combined effect of all road improvement projects expected to be completed before 1995.

- The resulting volumes were next multiplied by a growth factor to reflect increased travel demands generated by development projects outside the study area.

- Next, estimated traffic volumes generated by all known background developments within the study area were added. The resulting volumes are the 1995 No-Build volumes.

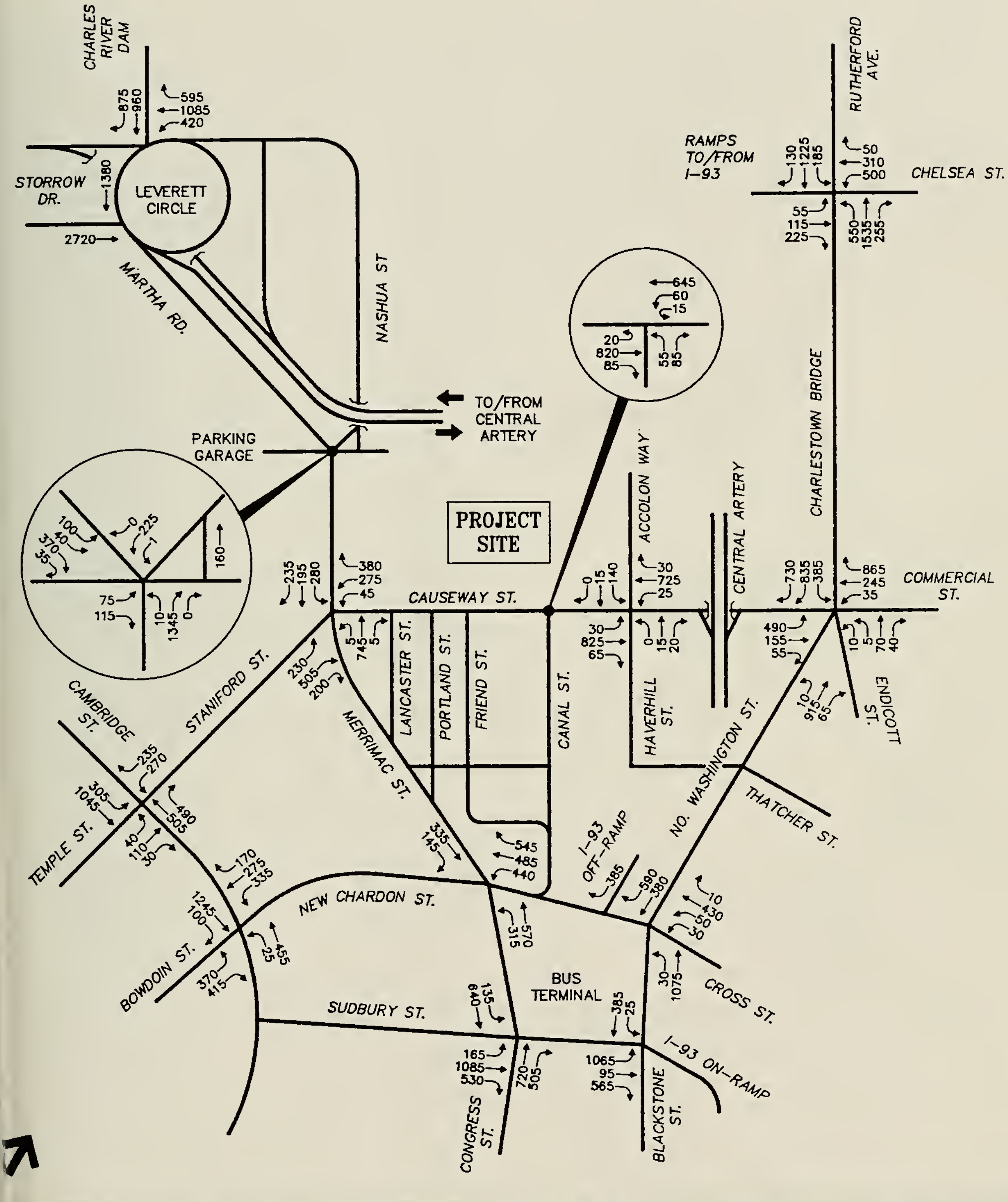
- Finally, project volumes generated by the first phase of the New Boston Garden Development were added. The resulting totals are the 1995 Interim-Build volumes.



Vanasse Hangen Brustlin, Inc.

1995 No-Build
Morning Peak Hour
Traffic Volumes

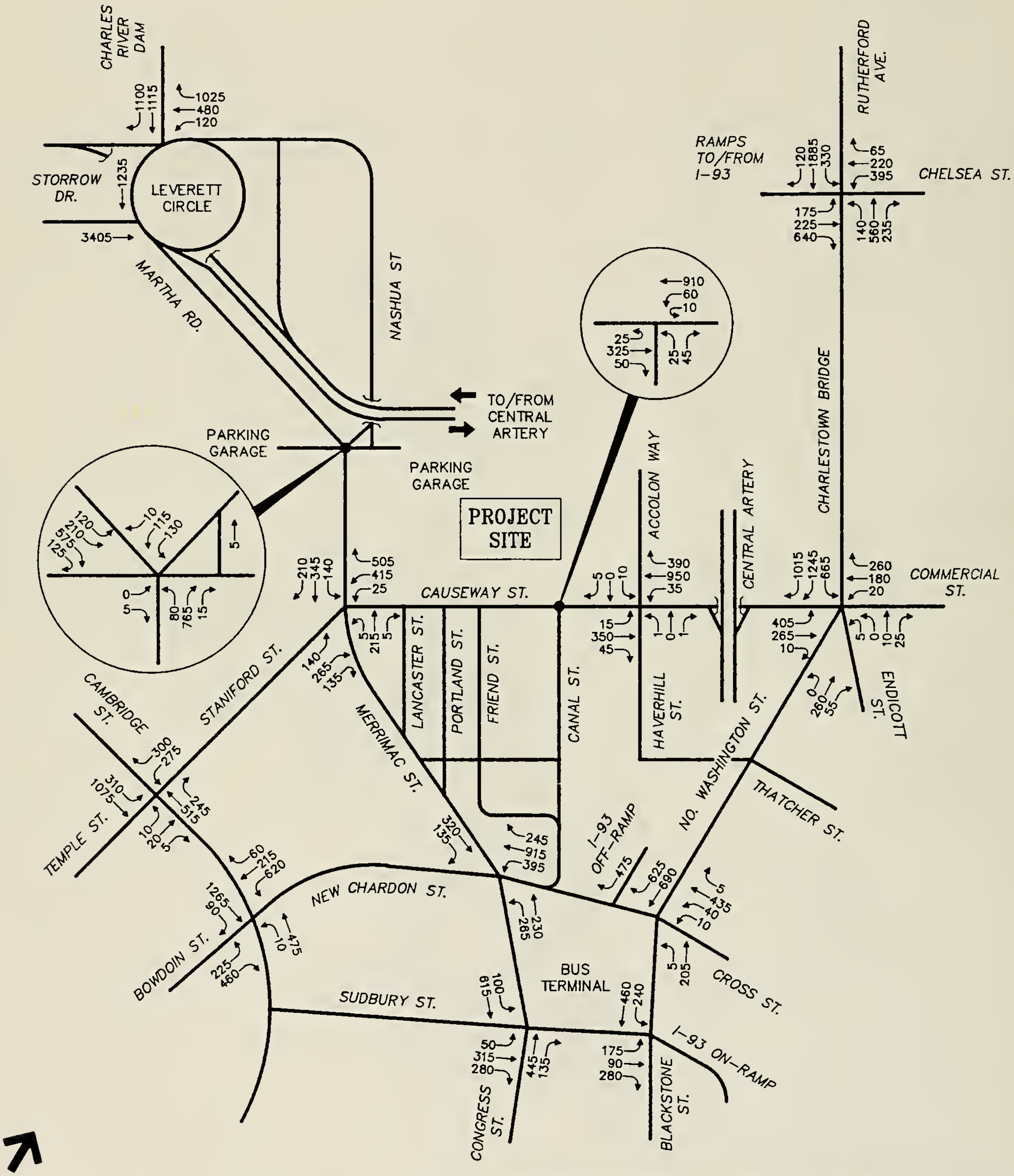
Figure IV-A-13



Vanasse Hangen Brustlin, Inc.

1995 No-Build
Evening Peak Hour
Traffic Volumes

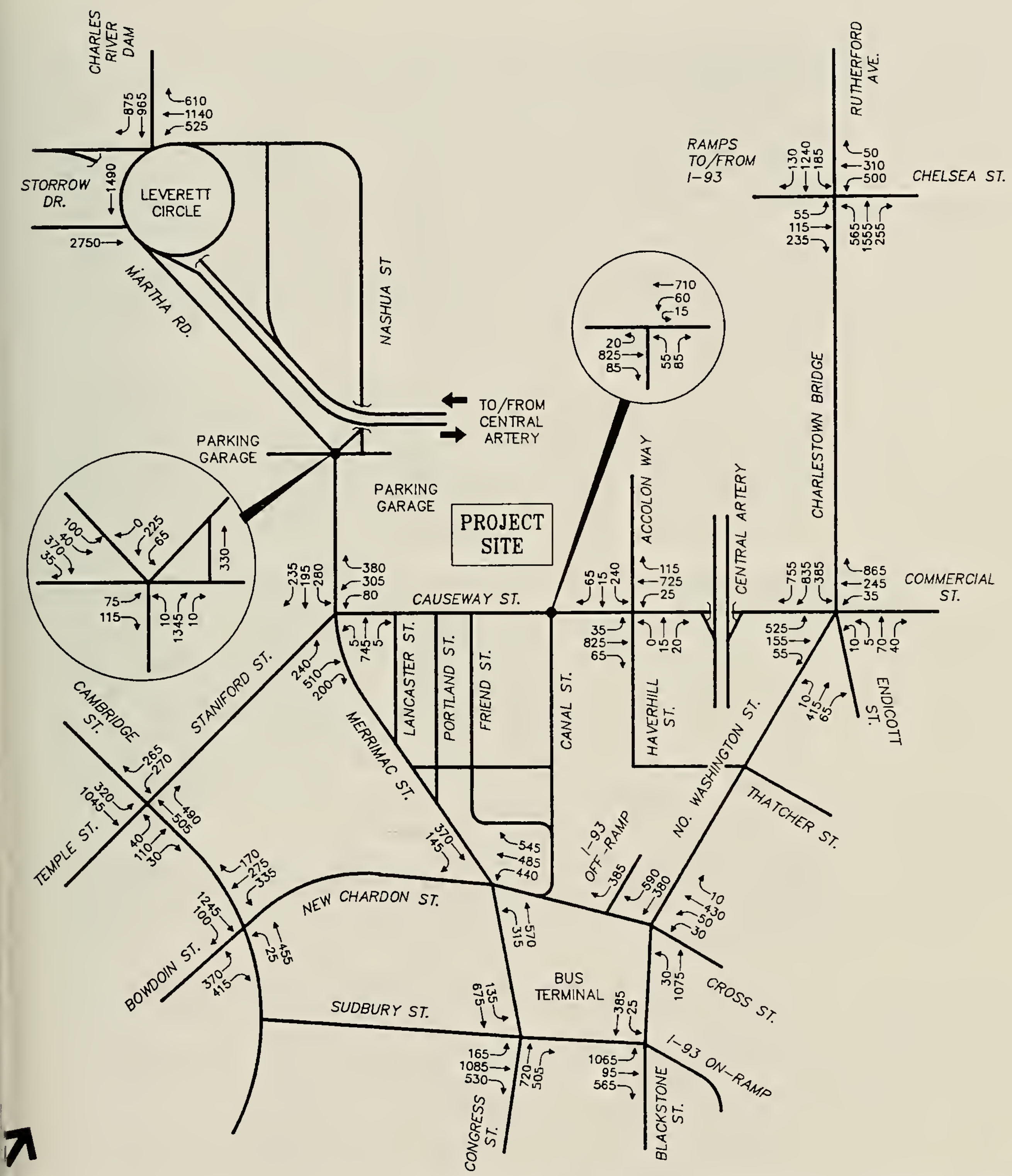
Figure IV-A-14



Vanasse Hangen Brustlin, Inc.

1995 Interim-Build
Morning Peak Hour
Traffic Volumes

Figure IV-A-15



Vanasse Hangen Brustlin, Inc.

1995 Interim-Build
Evening Peak Hour
Traffic Volumes

Figure IV-A-16

Effects of Road Improvements. Peak hour traffic volumes in 1995 will be affected by the following road improvement projects:

CANA. The Central Artery North Area (CANA) project is expected to be completed prior to 1995. Since traffic counts for the existing conditions analysis took place during the construction of CANA, they included vehicle movements associated with detours and diversions. By 1995, all diversions associated with CANA construction activities will have ended. In addition, because the CANA project will provide improved access to I-93 and, to a lesser extent, Route 1, other traffic volume changes were predicted to occur. CANA-related impacts were estimated for the Charlestown Bridge, Causeway Street, Martha Road, Nashua Street, and Leverett Circle.

One of the major components of the CANA project is the reconstruction of City Square in Charlestown. Upon completion of CANA, City Square will be a four-way signalized intersection serving both local traffic to and from Charlestown and regional traffic accessing and egressing I-93 and Route 1. To account for the anticipated changes, the existing traffic flows on all of the approaches to City Square were reallocated based on traffic forecasts developed by the Central Transportation Planning Staff for the CANA project.

Merrimac Street. Planned improvements to Merrimac Street will enable two-way traffic flow between New Chardon Street and Causeway Street. This committed project is expected to commence construction in 1991. In conjunction with the planned connector between Nashua Street and Lomasney Way, it will provide an improved route between Government Center and Leverett Circle, and will likely alter the travel patterns of motorists who may currently use Cambridge Street to access Storrow Drive. The improved connection will encourage more motorists to travel to Leverett Circle to access Storrow Drive. The effects of these changes were estimated based on analysis of traffic volume forecasts developed for the Central Artery project.

Central Artery/Tunnel Construction Activities. Construction activities related to the Central Artery project may introduce additional peak-hour traffic volume to the study area in 1995. However, it was not possible to account for this possibility explicitly, for several reasons:

- Information on daily and peak-hour construction vehicle volumes and routings is not yet available from the Central Artery project team
- Parking locations for construction workers have not yet been identified
- The schedule of various construction phases is not yet known
- Mitigation measures designed to reduce peak hour traffic volumes have not yet been identified

The last point is particularly significant because, during the recent reconstruction of the Southeast Expressway, the state succeeded in mitigating construction impacts by inducing greater use of carpooling and public transportation. It is entirely possible that the Central Artery team mitigation measures will completely offset peak-hour volume increases at study area intersections.

CA/T Construction-Related Displacement of Parking Spaces. The reconstruction of the Central Artery will require the closure of a number of parking facilities throughout downtown Boston. These closings will result in localized changes in traffic patterns as motorists use different streets to enter and exit alternative parking facilities. For purposes of the traffic analysis, the following assumptions were made regarding parking space changes:

- All parking spaces lost within the Causeway Street area will be replaced by the MBTA garage for 1995 and 2000
- The 73-space MDC parking area accessed via Accolon Way will be replaced outside the study area
- The regional distribution of vehicle trips to and from the study area will not change

The existing (1990) networks were adjusted to account for the road improvements described above. These traffic volume networks were then ready for the next steps in the development of the 1995 No-Build network: the application of a background growth rate and the assignment of trips associated with individual background development projects.

Background Traffic Growth. Background growth can be projected by applying a generalized growth factor or by assessing specific development projects and proposals. For the 1995 analysis, a combination of both approaches was used. A generalized growth rate was applied to existing traffic volumes to account for growth from developments outside the study area. Projections of traffic from known development projects in the study area were then added to the resulting volumes. This approach was approved by the Boston Transportation Department.

To account for regional growth from 1990 through 1995, an annual growth rate of 0.5 percent was used. Recent Metropolitan Area Planning Council (MAPC) employment projections for Boston were examined to estimate an annual growth rate during the first phase of the project. The data revealed that a small annual increase in employment is expected in the Boston area beyond 1990. Based on the data available, existing traffic movements at each analysis location were increased by 0.5 percent per year to reflect background growth from 1990 to 1995 from developments outside the study area.

Information about possible and proposed new development in the North Station area expected by 1995 was provided by the Boston Redevelopment Authority (BRA). Traffic volumes from projects that were either proposed, under construction, or complete but unoccupied as of April 1990 (when traffic counts were initiated) were included in 1995 No-Build traffic volumes. The specific background developments included in the 1995 No-Build scenario are listed in Table IV-A-33.

Table IV-A-33 **1995 BACKGROUND DEVELOPMENTS**

Development/Location	Office SF	Retail SF	Total SF*	New Parking Spaces
101 Merrimac Street	151,000	9,200	160,200	70
251 Causeway Street	151,000	9,000	160,000	0
Government Center Garage**	225,000	25,000	250,000	0

* Square feet.
** Refers to the commercial development above the garage (One Congress Street).

Trip generation rates were applied to the proposed building program for each background development to calculate projected traffic. The rates were the same as those used for the commercial component of the proposed New Boston Garden Development. Table IV-A-34 shows the number of entering and exiting peak hour trips estimated for the background developments. During the morning peak hour, 221 additional vehicle trips are expected from background developments in the area. In the evening peak hour, the projected number is 223.

Table IV-A-34 **BACKGROUND DEVELOPMENT 1995 VEHICLE-TRIP GENERATION***

Development	Morning Peak Hour		Evening Peak Hour	
	In	Out	In	Out
101 Merrimac Street	61	2	7	55
251 Causeway Street	61	2	7	54
Government Center Garage	91	4	13	87
TOTAL	213	8	27	196

* Calculated using the same trip generation rates as those used for the New Boston Garden Development.

Trip Distribution and Assignment. The distribution and assignment of vehicle trips to the study area roadway network is a function of the available parking supply, travel patterns, and travel distances to and from a particular site. To assess project impacts on study area roadways, vehicle trips generated by the proposed background developments in the study area were distributed to the projected roadway system. This distribution was based primarily on journey-to-work data from the building surveys in the Bulfinch Triangle discussed earlier in Project Travel Demand. The pattern for distributing trips to the regional highway system is given in Table IV-A-35. Assignments to specific roadways are based on the location of garage entrances, one-way streets, and connections to the regional highway system.

Table IV-A-35 PROJECT VEHICLE-TRIP DISTRIBUTION

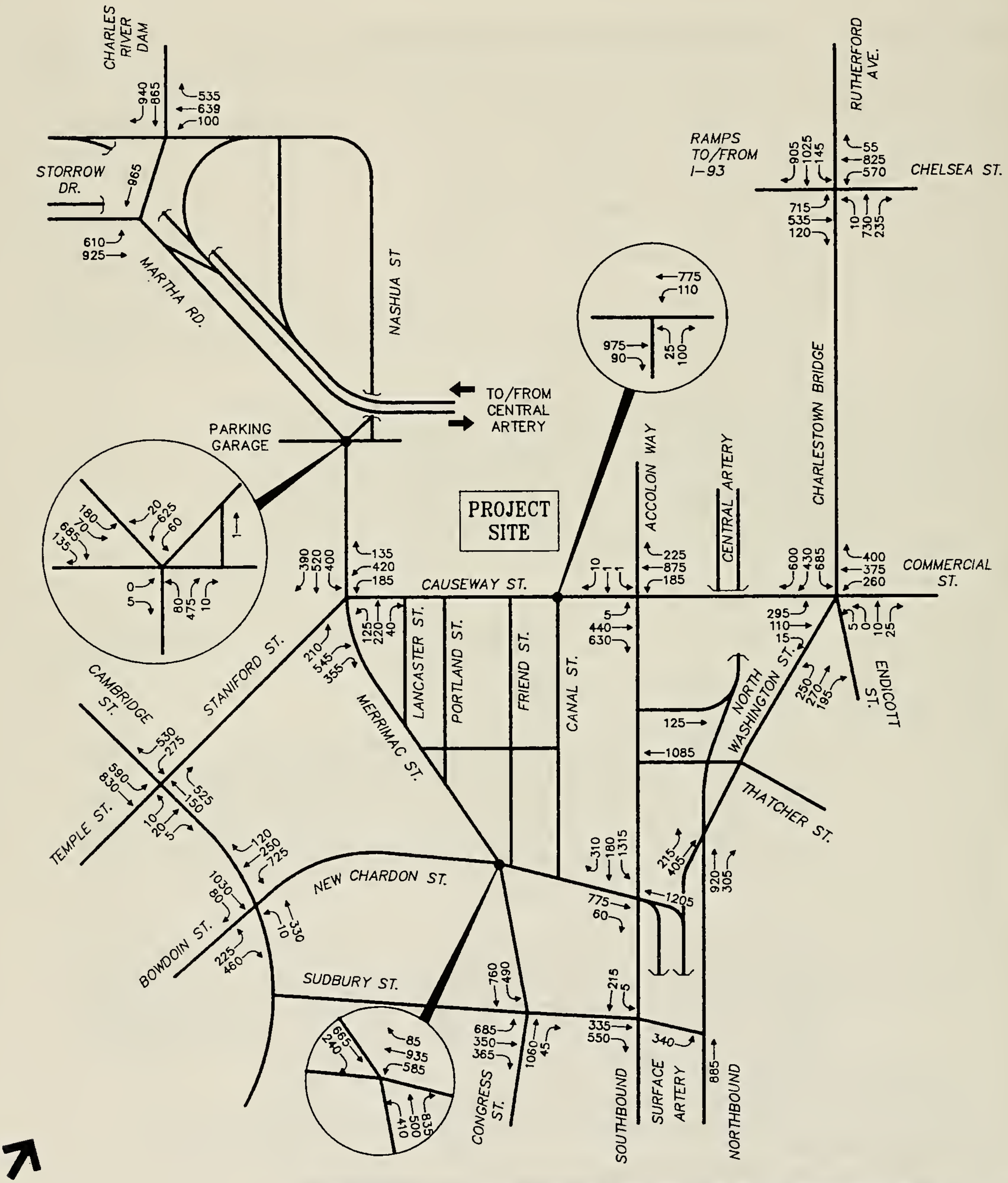
Route and Direction	Percent
Memorial Drive - Northwest	2
Monsignor O'Brien Highway - Northwest	2
Storrow Drive - West	24
I-93 - North	14
Rutherford Avenue - North	3
Route 1 - North	12
Sumner Tunnel and Callahan Tunnel - East	2
Massachusetts Turnpike - West	9
I-93 and Route 3 - South	32
TOTAL	100

2000 Peak Hour Traffic Volumes

Figures IV-A-17 through IV-A-20 present 2000 No-Build and Build volumes for the morning and evening peak hours. The development of the year 2000 traffic networks was completed using a different method from that used to develop the 1995 networks. Significant roadway changes, and therefore traffic diversions, are anticipated to result from the reconstruction of the Central Artery. For this reason, 2010 traffic volume projections from the Central Artery team were used to develop 2000 peak hour networks.

The CA/T team provided morning and afternoon peak hour traffic volumes for the CA/T Build conditions in 2010. These networks already reflected completion of the CA/T project and all other planned road improvements. They also included traffic generated by forecast development projects, including the New Boston Garden Development. The CA/T 2010 Build networks were used to develop the 2000 No-Build network for Boston Garden analysis as follows:

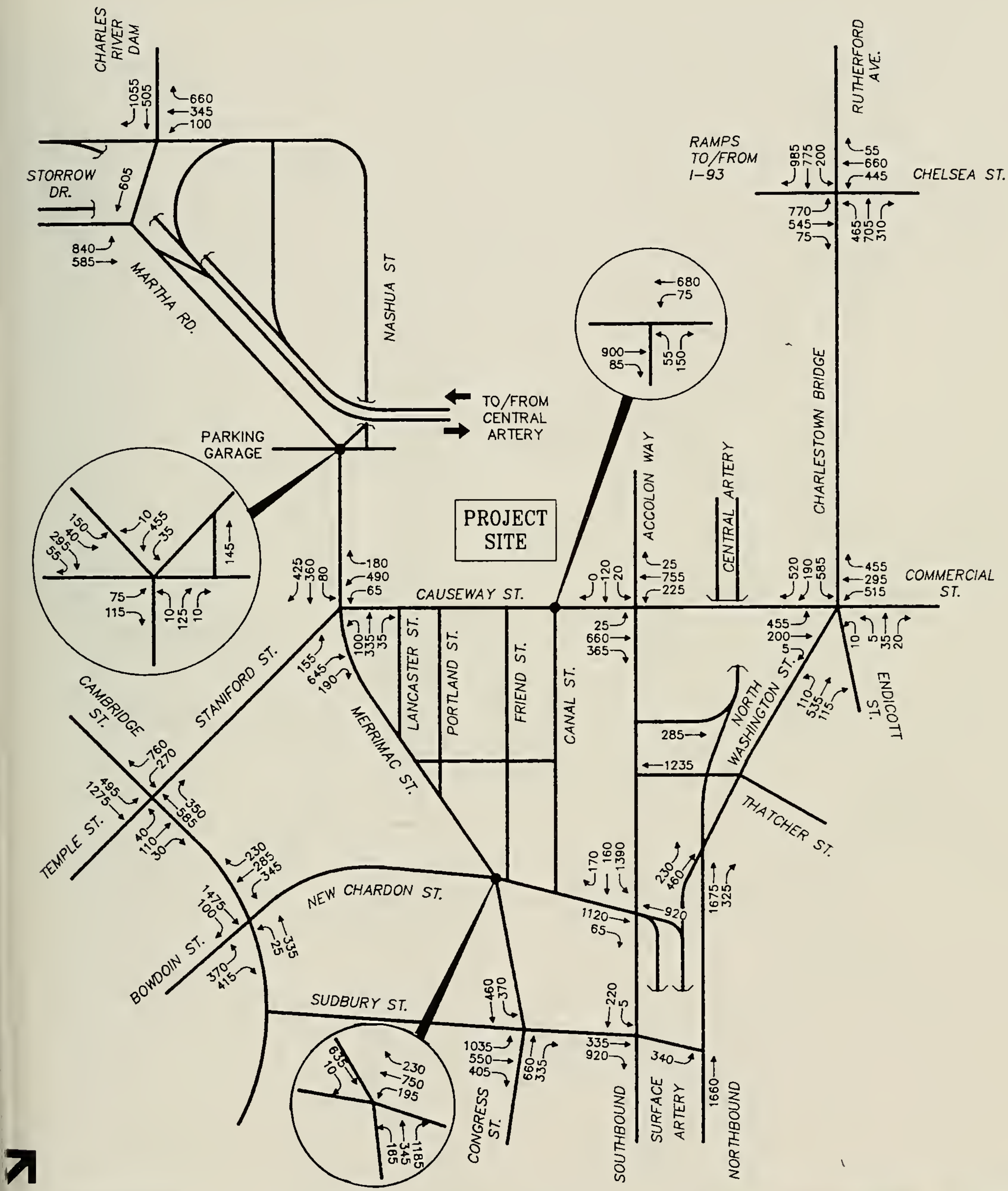
- Make necessary adjustments to refine the initial CA/T network to more accurately reflect the street network in the North Station area.
- Rectify inconsistencies which are tolerable for the regional impact analysis required for the CA/T project, but not tolerable for the localized impact analysis required for this Draft EIR/PIR.
- Subtract New Boston Garden Development trips from the network to produce a 2010 No-Build network.



Vanasse Hangen Brustlin, Inc.

2000 No-Build
Morning Peak Hour
Traffic Volumes

Figure IV-A-17



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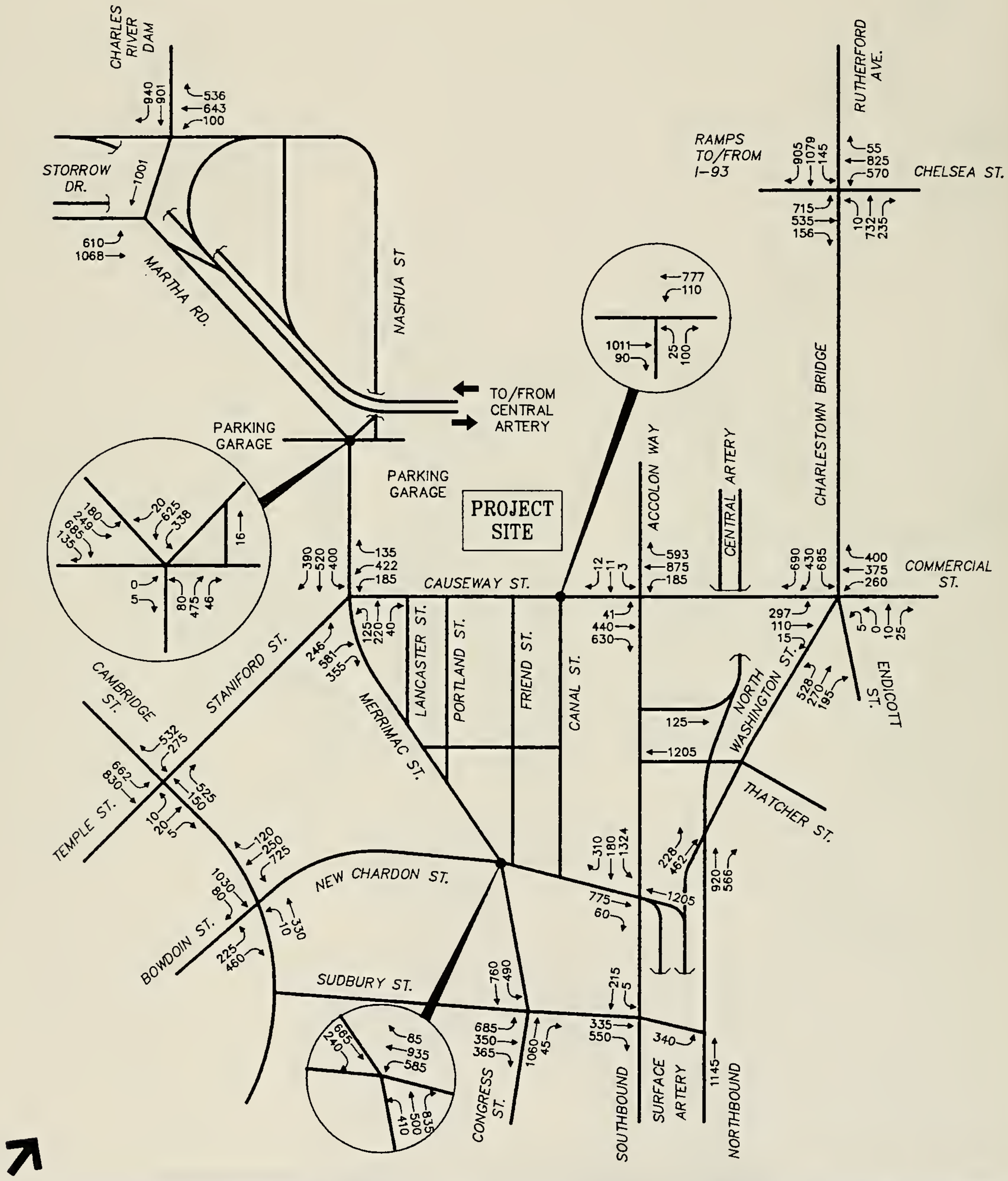
2000 No-Build
Evening Peak Hour
Traffic Volumes

Figure IV-A-18



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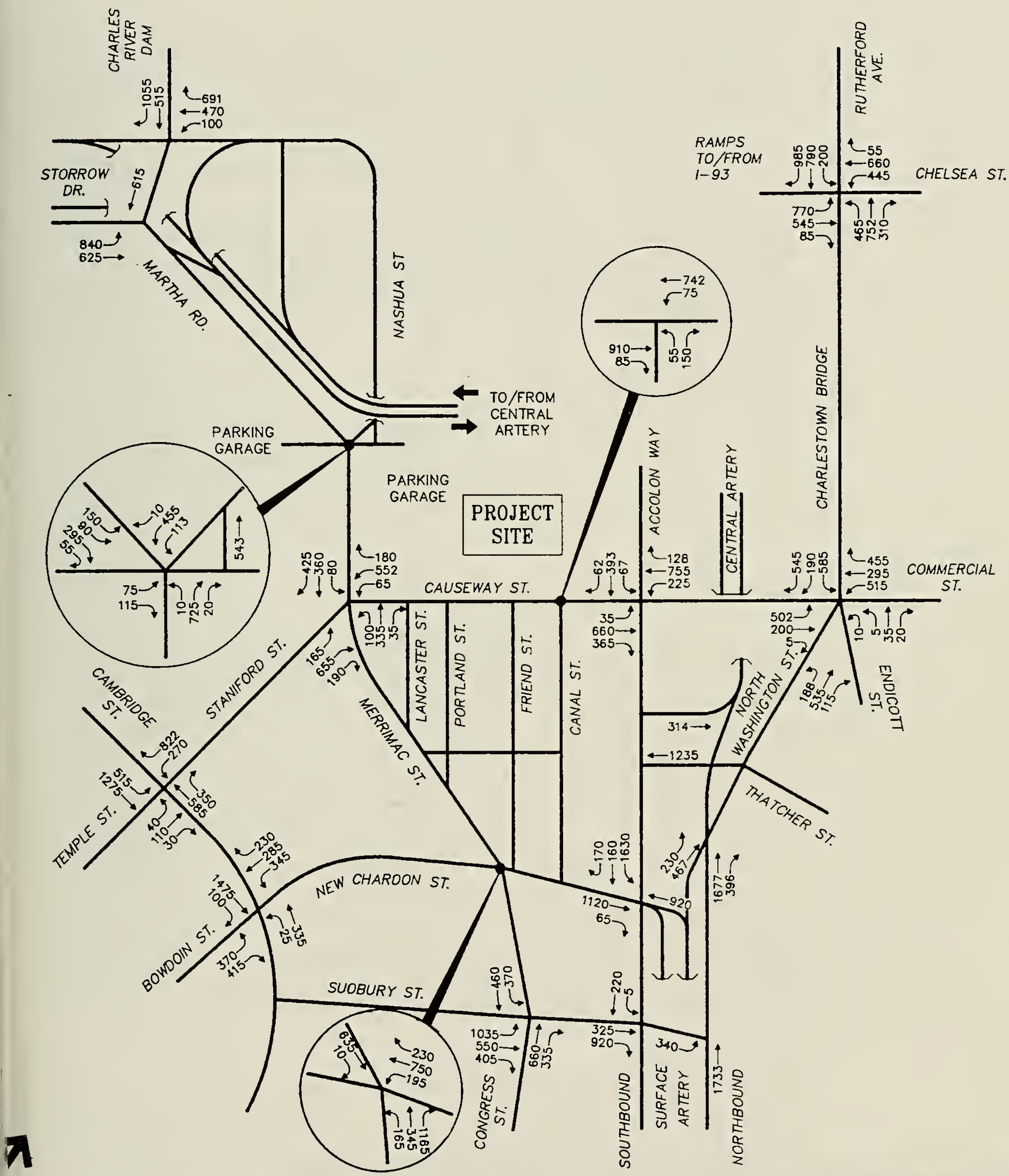
2000 Full-Build
Morning Peak Hour
Traffic Volumes

Figure IV-A-19



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2000 Full-Build
Evening Peak Hour
Traffic Volumes

Figure IV-A-20

- Reduce the 2010 No-Build traffic volumes to 2000 No-Build volumes by a "negative" growth rate of 1 percent per year. This factor was calculated from the land use change assumptions between 1995 and 2000 shown in the CA/T land use analysis. The result is the 2000 No-Build network.

- Add project traffic to the 2000 No-Build network to establish a 2000 Full-Build network.

The result of the analysis approach for developing the 2000 peak hour traffic networks is that the networks reflect the completion of the CA/T and its expected effects on traffic volumes. This approach was approved by the Boston Transportation Department.

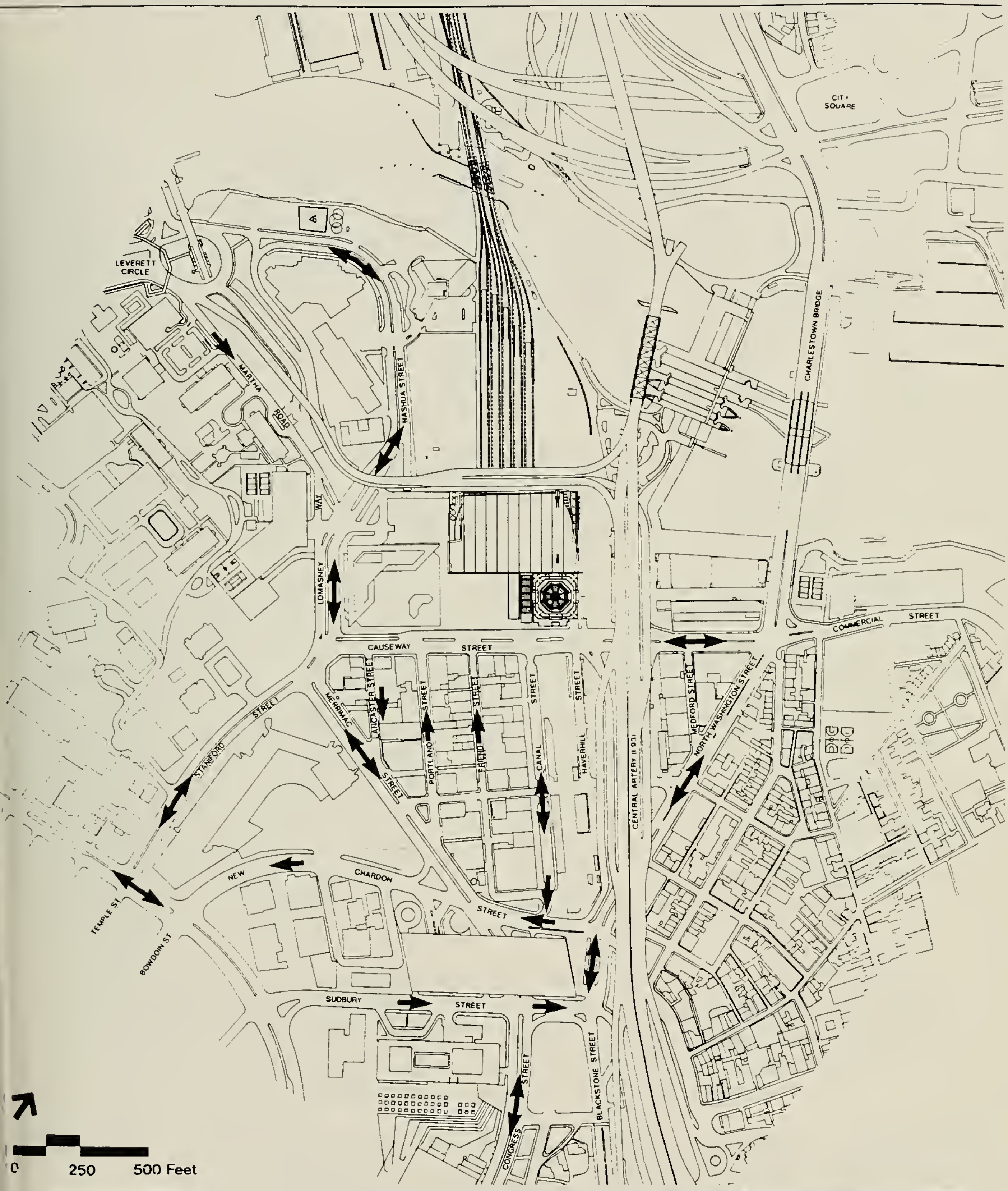
Intersection Improvements

This section updates the intersection descriptions presented in the Existing Conditions section to reflect expected geometric and signalization changes. Those changes are the result of the planned road improvements described earlier in this chapter. Traffic circulation for 1995 and 2000 is illustrated in Figures IV-A-21 and IV-A-22, respectively.

1995 Intersection Improvements

Nashua Street, Lomasney Way, and Martha Road. The proposed Nashua Street connector will eliminate Cotting Street and Minot Street. It will create a new signalized intersection of Nashua Street, Martha Road, the Charles River Park Public Garage driveway, and the proposed MBTA garage entrance driveway. (The project Garage will share the MBTA garage driveway.) The Nashua Street connector is planned to be constructed in two stages. The 1995 configuration (the Interim Design) will consist of two lanes northbound and three lanes southbound on Nashua Street. The Martha Road approach will contain four lanes: two for vehicles flowing south on Nashua Street/Lomasney Way, and two for vehicles headed into the MBTA garage. The left lane of the latter two can also be used for turns onto Nashua Street northbound. The Public Garage driveway will have the same geometry as under existing conditions. For purposes of computer analysis, the intersection was treated as a four-way signalized intersection with the Public Garage approach designated as westbound and the Martha Road approach designated as eastbound. The new signal is expected to be timed and phased as appropriate to optimize traffic service.

Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street. The intersection of Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street (Lowell Square) is expected to be affected by the Merrimac Street improvements and the geometric improvements proposed by the MBTA as mitigation for its proposed garage. After these projects are completed, Merrimac and Staniford streets will each have two approach lanes and one lane of parking. Lomasney Way will increase from two approach lanes, under Existing conditions, to three approach lanes by 1995. Causeway Street will contain two approach lanes at the intersection for through and left-turning vehicles. The MBTA plans to build an additional lane on Causeway Street to allow right-turning vehicles to bypass the signal.



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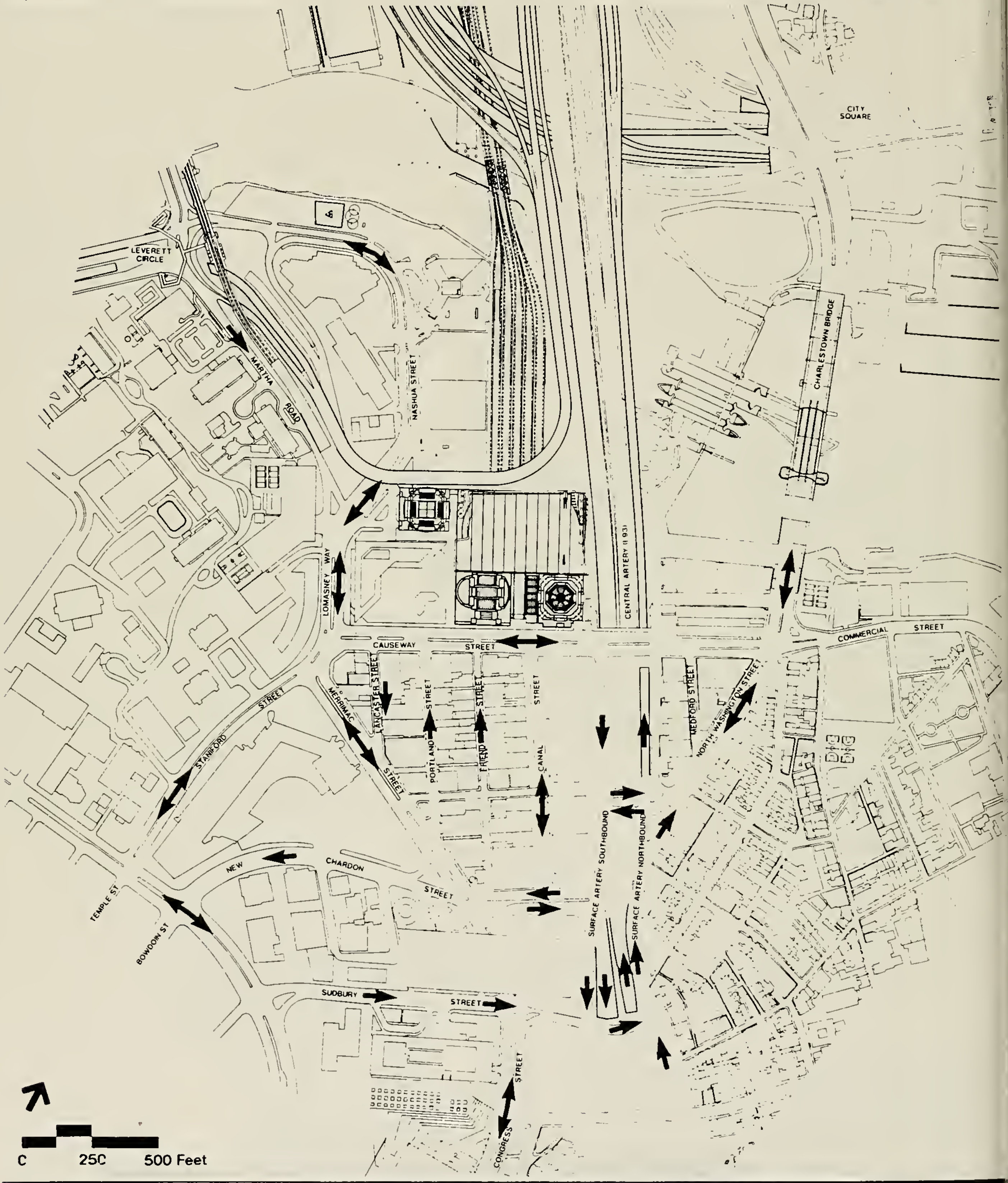
1995 Roadway Circulation Figure IV-A-21



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2000 Roadway Circulation Figure IV-A-22

City Square. CANA construction at City Square is expected to be completed by 1995. The proposed new signalized intersection at City Square will have four legs: Chelsea Street on the east, Rutherford Avenue on the north, the I-93 ramps on the west, and the Charlestown Bridge on the south. The state has decided on the total width of each leg of the intersection, but has not yet determined the location of medians or the lane use designations. Assuming the optimum location of medians and optimum lane use designations, the Charlestown Bridge will have five approach lanes, Rutherford Avenue will have six approach lanes, Chelsea Street will have four approach lanes, and the off-ramp will have three approach lanes.

2000 Intersection Improvements

Completion of the CA/T project will affect several analysis locations. In the year 2000, many analysis locations will be substantially different from what they were in 1995. Below is a list of geometric and signalization changes at study area intersections. This list includes two new intersections created by the Central Artery project which have been added to the list of study locations.

Leverett Circle. Leverett Circle is expected to change significantly as part of the Central Artery project. Due to these proposed changes, Leverett Circle will no longer operate as a traffic circle. These changes include a new underpass for eastbound Storrow Drive traffic (similar to the present westbound Storrow Drive underpass). The eastbound Storrow Drive approach will have four lanes, and the roadway between the north and south traffic signals at Leverett Circle will become a two-way street. The new Leverett Circle geometry will allow traffic on Nashua Street destined for I-93 to bypass the intersection via a new ramp. The southbound Charles River Dam Road approach and the westbound Nashua Street approach will be unchanged. In addition to these geometric changes, the two traffic signals at Leverett Circle will be retimed and rephased to provide optimal level of service. As a result of the new ramps, Leverett Circle in 2000 will function as two interdependent signalized intersections instead of as one signalized location. The two intersections are designated Leverett Circle North and Leverett Circle South in this report. The analysis is conducted separately but with identical signal timing.

Nashua Street, Lomasney Way, and Martha Road. By the year 2000, the Nashua Street connector will be reconstructed to the proposed long-term plan (Final Design). This improvement, made possible by the removal of the elevated Green Line, includes an added travel lane northbound and southbound on Nashua Street. It also assumes the traffic signal will be retimed in order to produce optimal levels of service for the new volumes and geometry.

Causeway Street, North Washington Street and Commercial Street. Completion of the CA/T project by 2000 is expected to significantly alter traffic patterns at the intersection of Causeway Street, North Washington Street, and Commercial Street (Keany Square). Therefore, it is assumed that the traffic signal timing and phasing will be adjusted. This adjustment is expected to be made by police officers who control the intersection during peak hours and should consist of a separate phase for each traffic approach (northbound, southbound, eastbound and westbound phase). No geometric changes were assumed in the analysis because the proposed City of Boston design at this intersection has not been finalized.

City Square. The CA/T project will also result in major changes to traffic patterns at City Square. It is assumed that the signal installed by 1995 as part of the CANA project will be retimed and rephased by 2000 to accommodate the new travel patterns.

New Chardon Street and Merrimac Street. A new eastbound roadway will be created by the CA/T project on New Chardon Street, transforming the roadway from a one-way westbound street to a two-way street between Merrimac Street and the southbound Surface Artery. As a result, travel patterns are expected to be significantly different than under Existing or 1995 conditions. The signal is expected to be retimed and rephased to optimize traffic service.

New Chardon Street and Surface Artery Southbound. The CA/T project will create a new southbound one-way roadway (Surface Artery Southbound) and change a section of New Chardon Street into a two-way street when completed. At this intersection, Surface Artery Southbound will consist of four travel lanes. Vehicles may turn right onto New Chardon Street, proceed through the intersection onto a Central Artery on-ramp, or continue through on the Surface Artery. Eastbound traffic on New Chardon Street will have three travel lanes under the CA/T plans. It is assumed the signal timing and phasing will be optimized appropriately to process intersection traffic volumes.

Congress Street, Sudbury Street and Merrimac Street. The CA/T project is not expected to make any geometric changes at the intersection of Sudbury, Congress and Merrimac streets. However, travel patterns are excepted to change significantly due the project. Intersection signal timing and phasing are expected to be upgraded and optimized in order to accommodate large shifts in traffic volumes due to the Central Artery project.

Sudbury Street, Surface Artery Southbound. The new intersection of Sudbury Street and Surface Artery Southbound will be created by the CA/T project. Sudbury Street and Surface Artery Southbound will effectively replace the existing intersection of Sudbury, North Washington, and Blackstone streets. The new intersection will consist of three eastbound travel lanes on Sudbury Street and two travel lanes on the Surface Artery Southbound. Sudbury Street traffic destined to the north will travel straight ahead through the intersection and turn left at the new intersection of Sudbury Street and Surface Artery Northbound. Signal timing and phasing are expected to be optimized as part of the CA/T project.

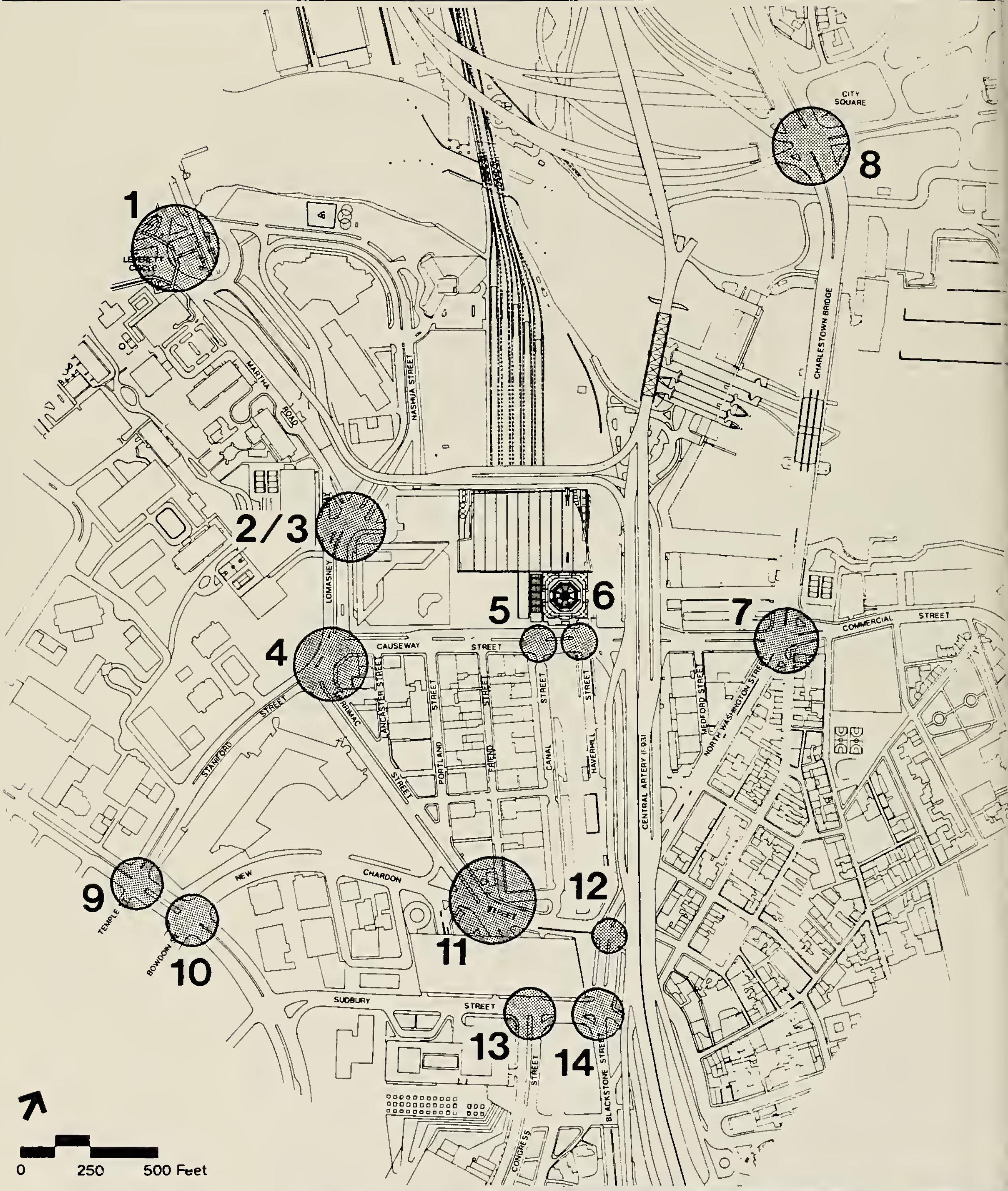
Sumner Tunnel Ramp, Surface Artery Northbound, and North Washington Street. The CA/T project will create the new intersection of the Sumner Tunnel ramp, Surface Artery Northbound, and North Washington Street. Traffic will approach from two directions, northbound (Surface Artery) and eastbound (Sumner Tunnel). Surface Artery Northbound will consist of three approach lanes, while the Sumner Tunnel ramp will consist of two approach lanes. The intersection will be signalized and is expected to be designed for optimal signal performance.

Sudbury Street and Surface Artery Northbound. Finally, the CA/T project will create the new intersection of Sudbury Street and Surface Artery Northbound. Sudbury Street will be a one-way, two-lane street eastbound, and Surface Artery Northbound will consist of three travel lanes. The intersection will be signalized and is expected to be designed for optimal signal performance.

Intersection Level-of-Service Analysis Results

Summary of Analysis Results

Analysis procedures for future intersection level-of-service is based on the Highway Capacity Manual (HCM), as described in the Existing Conditions section of this chapter. Figures IV-A-23 and IV-A-24, respectively, show the 1995 and 2000 intersection analysis locations. As explained previously, intersection levels-of-service A through D are considered acceptable in urban areas, while levels-of-service E and F are considered deficient. Tables IV-A-36 and IV-A-37 provide a summary of signalized intersection analysis results for 1995 and 2000 Existing, No-Build, and Build conditions. Tables IV-A-38 and IV-A-39 provide a summary of unsignalized intersection analysis results. The results of these analyses are summarized and discussed in greater detail in the following section. Post-mitigation results are discussed at the end of this chapter.



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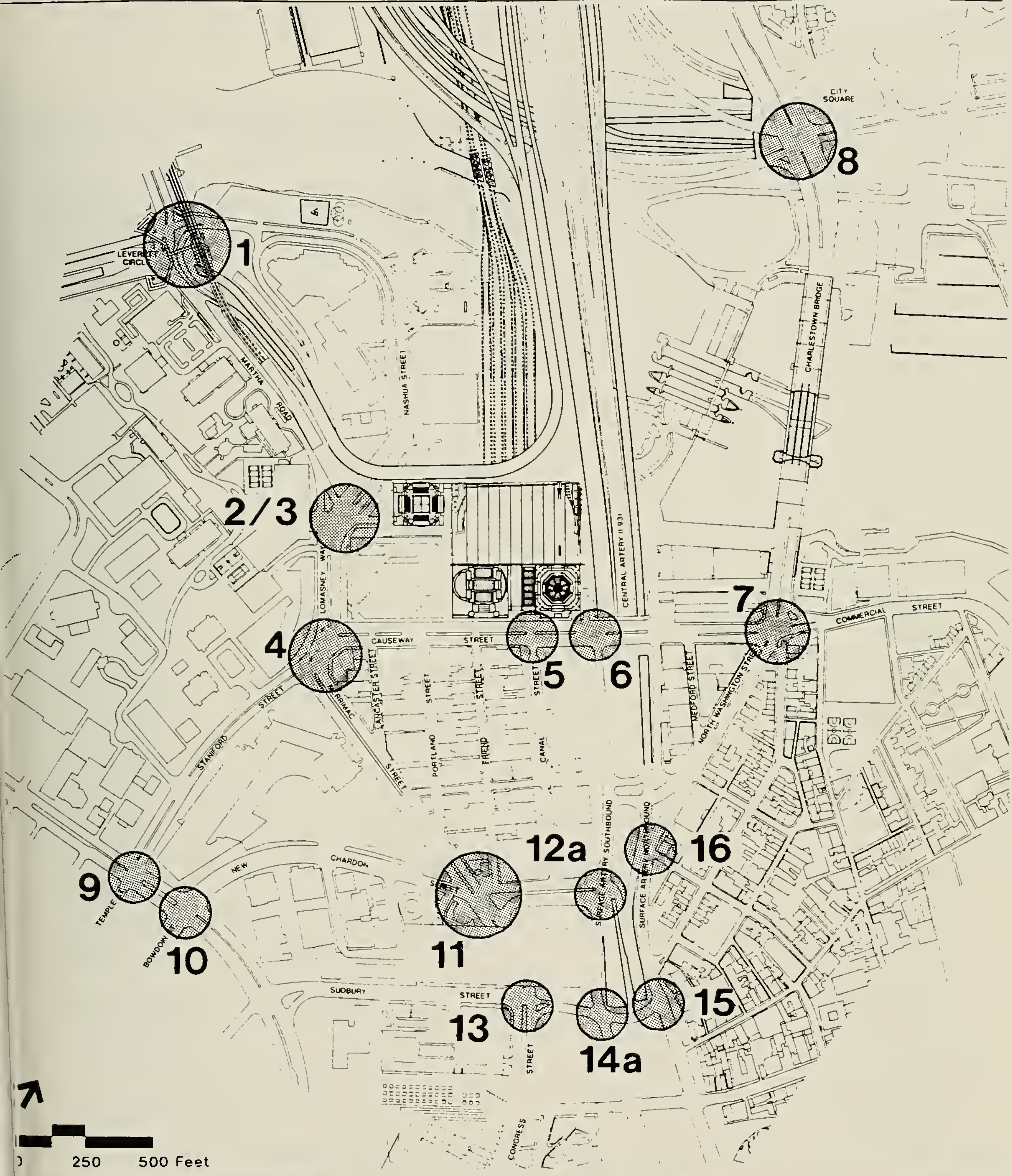
1995 Traffic Analysis Locations Figure IV-A-23



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2000 Traffic Analysis Locations Figure IV-A-24

Table IV-A-36 SIGNALIZED INTERSECTION LEVEL OF SERVICE MORNING PEAK HOUR

Intersection Number and Location		Existing			1995						2000					
					No-Build			Build			No-Build			Build		
		V/C*	Delay**	LOS***	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
1	Leverett Circle	1.00	60+^	F	1.19	60+^	F	1.21	60+^	F	-	-	-	-	-	-
	North	-	-	-	-	-	-	-	-	-	0.96	17	C	0.97	17	C
	South	-	-	-	-	-	-	-	-		0.75	12	B	0.82	12	B
2/3	Nashua St./ Lomasney Way/ Martha Rd.	-	-	-	0.59	12	B	0.63	12	B	0.60	13	B	0.60	13	B
4	Causeway St./ Lomasney Way/ Staniford St./ Merrimac St.	0.70	30	D	0.61	20	C	0.63	21	C	1.92	120+^^	F	2.43	120+^^	F
7	Causeway St./ N. Washington St./ Commercial St.	1.01	49	E	1.00	43	E	1.03	46	E	1.10	97	F	1.13	107	F
8	City Square	1.02	39	D	1.00	56	E	1.02	58	E	1.11	85	F	1.12	87	F
9	Cambridge St./ Staniford St./ Temple St.	0.68	24	C	0.64	19	C	0.67	20	C	0.94	120+^^	F	1.13	120+^^	F
10	Cambridge St./ New Chardon St./ Bowdoin St.	0.80	37	D	0.83	42	E	0.83	42	E	0.76	68	F	0.76	68	F
11	New Chardon St./ Merrimac St.	0.65	18	C	0.68	19	C	0.68	19	C	0.94	26	D	0.94	26	D
12	New Chardon St./ N. Washington St.	0.74	22	C	0.78	27	D	0.78	27	D	-	-	-	-	-	-
12A	New Chardon St./ Surface Artery SB	-	-	-	-	-	-	-	-	-	0.79	18	C	0.79	18	C
13	Sudbury St./ Merrimac St./ Congress St.	0.55	22	C	0.56	22	C	0.57	22	C	0.93	27	D	0.93	26	D
14	Sudbury St./ N. Washington St./ Blackstone St.	0.51	18	C	0.52	18	C	0.52	18	C	-	-	-	-	-	-
14A	Sudbury St./ Surface Artery NB	-	-	-	-	-	-	-	-	-	0.40	13	B	0.40	13	B
15	Sumner Tunnel Ramp/ Surface Artery NB/ N. Washington St.		-	-	-	-	-	-	-	-	0.53	8	B	0.65	9	B
16	Sudbury St./ Surface Artery NB	-	-	-	-	-	-	-	-	-	0.34	9	B	0.40	9	B

* Volume-to-capacity ratio.
** Average stopped delay per vehicle in seconds.
*** Level of service.
^ Delay is estimated to be more than 60 seconds, therefore LOS F.
^^ Delay exceeds 120 seconds and cannot be computed accurately by CINCH.

Table IV-A-37 SIGNALIZED INTERSECTION LEVEL OF SERVICE EVENING PEAK HOUR

Intersection Number and Location		Existing			1995						2000					
					No-Build			Build			No-Build			Build		
		V/C*	Delay**	LOS***	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
1	Leverett Circle	1.01	60+^	F	1.09	60+^	F	1.17	60+^	F	-	-	-	-	-	-
	North	-	-	-	-	-	-	-	-	-	0.95	14	B	0.99	18	C
	South	-	-	-	-	-	-	-	-	-	0.54	9	B	0.55	9	B
2/3	Nashua St./ Lomasney Way/ Martha Rd.	-	-	-	0.75	16	C	0.92	18	C	0.48	16	C	0.48	16	C
4	Causeway St./ Lomasney Way/ Staniford St./ Merrimac St.	0.66	26	D	1.03	51	E	1.05	55	E	0.86	30	D	0.86	33	D
7	Causeway St./ N. Washington St./ Commercial St.	1.01	45	E	0.98	43	E	1.00	45	E	1.09	89	F	1.11	100	F
8	City Square	0.98	26	D	0.81	34	D	0.81	35	D	1.23	107	F	1.23	120+^^	F
9	Cambridge St./ Staniford St. Temple St.	0.76	18	C	0.61	17	C	0.67	19	C	1.28	120+^^	F	1.35	120+^^	F
10	Cambridge St./ New Chardon St./ Bowdoin St.	0.84	47	E	0.87	55	E	0.87	55	E	0.97	58	E	0.97	58	E
11	New Chardon St./ Merrimac St.	0.77	29	D	0.71	21	C	0.72	21	C	1.09	31	D	1.09	31	D
12	New Chardon St./ N. Washington St.	0.63	14	B	0.65	14	B	0.65	14	B	-	-	-	-	-	-
12A	New Chardon St./ Surface Artery SB	-	-	-	-	-	-	-	-	-	0.77	18	C	0.87	21	C
13	Sudbury St./ Merrimac St./ Congress St.	0.86	29	D	0.89	34	D	0.89	34	D	0.83	23	C	0.83	23	C
14	Sudbury St./ N. Washington St./ Blackstone St.	0.61	21	C	0.63	21	C	0.63	21	C	-	-	-	-	-	-
14A	Sudbury St./ Surface Artery NB	-	-	-	-	-	-	-	-	-	0.56	12	B	0.56	12	B
15	Sumner Tunnel Ramp/ Surface Artery NB/ N. Washington St.		-	-	-	-	-	-	-	-	0.81	12	B	0.81	12	B
16	Sudbury St./ Surface Artery NB	-	-	-	-	-	-	-	-	-	0.52	8	B	0.54	8	B

* Volume-to-capacity ratio.
** Average stopped delay per vehicle in seconds.
*** Level of service.
^ Delay is estimated to be more than 60 seconds, therefore LOS F.
^^ Delay exceeds 120 seconds and cannot be computed accurately by CINCH.

Table IV-A-38 UNSIGNALIZED INTERSECTION LEVEL OF SERVICE MORNING PEAK HOUR

Intersection Number and Location	Existing		1995				2000			
			No-Build		Build		No-Build		Build	
	ARC*	LOS**	ARC	LOS	ARC	LOS	ARC	LOS	ARC	LOS
5 Causeway Street and Canal Street	121	D	196	D	190	D	24	E	13	E
6 Causeway Street, Accolon Way, and Haverhill Street	115	D	158	D	100	D	32	E	-7	F

* Available reserve capacity.
** Level of service.

Table IV-A-39 UNSIGNALIZED INTERSECTION LEVEL OF SERVICE EVENING PEAK HOUR

Intersection Number and Location	Existing		1995				2000			
			No-Build		Build		No-Build		Build	
	ARC*	LOS**	ARC	LOS	ARC	LOS	ARC	LOS	ARC	LOS
5 Causeway Street and Canal Street	-6	F	-1	F	-16	F	-49	F	-49	F
6 Causeway Street, Accolon Way, and Haverhill Street	4	E	-109	F	-291	F	-134	F	-571	F

* Available reserve capacity.
** Level of service.

The tables show that in the morning peak hour and evening peak hour, no change in level of service is expected due to 1995 project volumes. In 2000, analysis indicates that during the morning peak hour, one unsignalized intersection (Causeway Street, Accolon Way, and Haverhill Street) will decline in level of service. In the evening peak hour, one signalized intersection (Leverett Circle North) is expected to decline from LOS B to LOS C. None of the study area intersections are expected to become deficient as a result of the 2000 Full-Build project volumes. The project also results in some changes to volume-to-capacity ratios; these changes are noted in a later section.

Thus, the traffic generated by the proposed New Boston Garden Development in 2000 results in a deterioration in level of service at only one study area intersection in each peak hour. No level-of-service changes result in 1995. Moreover, recommended mitigation measures will significantly improve intersection level of service at many analysis intersections, as discussed in the Transportation Mitigation Plan presented at the end of the chapter.

1995 Intersection Analysis Results

1995 Signalized Intersection Level-of-Service Results. During the 1995 No-Build morning peak hour, four of the eleven signalized intersections are projected to operate at deficient levels of service (E or F). Two of these intersections are deficient under Existing conditions, while at City Square and the intersection of Cambridge Street, New Chardon Street, and Bowdoin Street, level of service is expected to deteriorate from Existing conditions to LOS E under 1995 No-Build conditions. At the intersection of Cambridge, New Chardon, and Bowdoin streets, where no project traffic is expected, minor adjustments to signal timing can achieve acceptable levels of service (for morning and evening peak hours).

The addition of project traffic in the 1995 Interim-Build condition is not expected to decrease intersection level of service at any study locations under 1995 morning peak hour conditions. Moreover, at the intersection of Causeway, North Washington and Commercial streets, which operates at deficient levels of service under all 1995 conditions, the project with the recommended mitigation will result in level of service and delay equal to or better than No-Build levels. At the remaining seven signalized locations, level of service is anticipated to remain acceptable under 1995 Interim-Build morning peak hour conditions.

In the evening peak hour, four of the eleven signalized intersections are expected to operate at LOS E or F under 1995 No-Build conditions. Three of these intersections are deficient under existing conditions. The addition of 1995 Interim-Build project traffic is not expected to cause the level of service to deteriorate at any of the signalized intersections. Level of service will continue to be acceptable at seven intersections under 1995 Interim-Build evening peak hour conditions.

1995 Unsignalized Intersection Level-of-Service Results. Under 1995 No-Build conditions, the two unsignalized intersections (Causeway Street, Accolon Way and Haverhill Street, and Causeway Street and Canal Street) are expected to operate at satisfactory levels of service in the morning peak hour and at deficient levels of service (LOS F) under 1995 No-Build evening peak hour conditions. Except for the intersection of Causeway Street, Accolon Way, and Haverhill Street in the evening peak hour, 1995 No-Build levels of service match existing levels. The addition of 1995 Interim-Build project volumes does not change the level of service at either of the two unsignalized intersections. Proposed mitigation for 1995 includes the signalization of these two intersections, which improves their level of service to the acceptable range under 1995 Interim-Build morning and evening peak hour conditions.

2000 Intersection Analysis Results

2000 Signalized Level-of-Service Results. Under 2000 No-Build conditions, five of the thirteen signalized intersections are projected to operate at deficient levels of service in the morning peak hour. The addition of project traffic is not expected to cause the level of service to deteriorate at any of the study signalized intersections from No-Build conditions. Traffic will continue to operate at acceptable levels of service at the remaining eight signalized locations under the 2000 Build morning peak hour conditions. Recommended mitigation measures will improve three of the deficient signalized intersections to acceptable levels of service and will improve one location to LOS E. The remaining deficient location, City Square, processes only a small amount of project traffic (2 percent of total approach volume).

In the evening peak hour, four intersections are projected to operate at deficient levels of service under 2000 No-Build conditions. The addition of project traffic in 2000 is not expected to cause the level of service to deteriorate at any of these deficient signalized locations. Intersections will continue to operate under acceptable conditions at the remaining nine signalized locations in the 2000 Full-Build evening peak hour. Proposed mitigation measures are expected to improve two deficient intersections to acceptable levels of service and restore one additional deficient location to better than 2000 No-Build level of service.

2000 Unsignalized Level-of-Service Results. For 2000 No-Build conditions, the same two unsignalized intersections as in 1995 condition were analyzed (Causeway Street, Accolon Way and Haverhill Street, and Causeway Street and Canal Street). Both intersections are projected to operate at deficient levels of service during both the morning and evening peak hours. The addition of project traffic is expected to cause the level of service to deteriorate at one intersection during the 2000 Full-Build morning peak hour. Proposed signalization of these two locations would result in acceptable levels of service for both intersections under morning and evening Full-Build conditions, except at the intersection of Causeway Street, Accolon Way, and Haverhill Street during evening conditions, which is projected to improve to LOS E.

Effects on Volume-to-Capacity Ratios in 1995 and 2000

When a signalized intersection's volume-to-capacity ratio (v/c) reaches 0.95, significant further increases in v/c are usually accompanied by noticeable increases in delay, as traffic demand reaches or exceeds capacity. However, v/c has little effect on delay when v/c is below 0.95; for example, Table IV-A-37 shows that the change from 0.75 to 0.92 between 1995 No-Build and 1995 Build conditions at the intersection of Nashua Street, Lomasney Way, and Martha Road in the evening peak hour causes only a 2-second increase in intersection delay.)

Therefore, the signalized intersection analysis results presented in Tables IV-A-36 and IV-A-37 were reviewed to identify each case where the volume-to-capacity ratio projected for the Build condition is at least 0.95 and is also at least 0.05 greater than that projected for the corresponding No-Build condition. In 1995, there are no such cases in the morning peak hour and just one such case (Leverett Circle) in the evening peak hour. In 2000, there are two such cases in the morning peak hour: the intersection of Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street and the intersection of Cambridge Street, Staniford Street, and Temple Street. The latter intersection is the only such case in the evening peak hour.

Arena-Only Intersection Analysis

An analysis was conducted to evaluate the impact of the New Boston Garden on intersection level of service at study locations. The evening peak hour was examined because arena events have no effect during the morning peak hour.

The analysis year selected for this evaluation was 1995 rather than 2000, since the arena is scheduled for completion before 1995 (actually in 1993). It is evident from Tables IV-A-36 through IV-A-39 that, at all intersections other than Leverett Circle, 1995 Interim-Build operating conditions, including v/c ratios, levels of service, and delays, are either acceptable or are similar to 1995 No-Build conditions. Since the Interim-Build condition includes the entire new Boston Garden and a portion of the commercial component, it is clear that, excluding Leverett Circle, the New Boston Garden does not cause, and does not significantly contribute to, any deficient conditions in 1995.

Leverett Circle will continue to operate at deficient levels of service under all 1995 conditions. The difference in evening peak hour v/c ratio between 1.09 under 1995 No-Build conditions and 1.17 under 1995 Interim-Build conditions (including the New Boston Garden and a portion of the commercial component) may be considered significant enough to merit an analysis to separate the effects of the arena and the commercial component.

This analysis was conducted by adding only the arena portion of the 1995 project vehicle trips to the 1995 No-Build traffic network at Leverett Circle. A level-of-service analysis was performed for Leverett Circle using the procedures described in the Existing Conditions section of this chapter.

The results indicated that the 1995 evening peak hour v/c ratio at Leverett Circle, if only the New Boston Garden (and all background developments) are operating in 1995, would be 1.13, exactly half way between the 1.09 No-Build condition and the 1.17 Interim-Build condition. Thus, at Leverett Circle, the effects of the arena are only half as much as the effects of the entire 1995 Interim-Build program. The arena's relatively minor effect at Leverett Circle is due to the fact that the New Boston Garden is a replacement facility for the existing arena. At all other locations, the arena's effects may be considered insignificant, as explained earlier.

It should also be noted that the arena has no effect during the morning peak hour, and that its evening peak hour effects occur only on days when an event is scheduled. Due to all these factors, the traffic impacts of the arena are minor.

Parking

This section presents the proposed project parking demand for the arena and commercial components separately. Areawide supply and demand, including additional projects proposed in the North Station area, is also presented in this section.

Project Parking Demand

Arena. Parking demand rates for the arena component of the New Boston Garden Development are anticipated to be the same as for the existing Boston Garden. The increase in parking demand is expected to be be equivalent to the parking demand rate per seat multiplied by the number of new seats to be added by the project. Table IV-A-40 presents the number of new parking spaces required for both a basketball game and a hockey game based on the number of new seats that will be available for each type of game. As under Existing conditions, a sufficient area supply will be available to meet this increased demand during off-peak hours.

Table IV-A-40 ARENA PARKING DEMAND

Event/Seat Type	Existing Parking Demand	Parking Spaces per Seat	Number of New Seats	New Parking Demand	Total Future Parking Demand
Hockey:					
Executive and Club*	167	0.379	3,052	1,157	1,324
General	4,253	0.305	-383	-86	4,167
TOTAL	4,420		2,669	1,071	5,491
Basketball:					
Executive and Club	153	0.348	3,052	1,062	1,215
General	4,028	0.279	421	117	4,145
TOTAL	4,181		3,473	1,179	5,360

* Skybox for existing arena.

Office and Retail Component. The number of parking spaces required by the office and retail component of the New Boston Garden Development was estimated from the trip generation projections for these uses. Parking requirements are divided into long-term employee parking and short-term business, visitor, and shopper parking. Turnover rates of 1.0 car per space per day for long-term employee parking and 2.67 for short-term visitor and shopper parking were applied to the projected number of vehicles arriving at the site each day. Turnover rates represent the average number of vehicles that use a space each day. For employees, only one vehicle is assumed to use a space each day, while for visitors whose stays are shorter, an average of 2.67 vehicles per day are expected to use each space. The short-term turnover rate is taken from Parking in Central Boston: Meeting the Access Needs of a Growing Downtown.[4]

As shown in Table IV-A-41, 792 spaces are estimated to be required to meet the demands of the first phase of the proposed development. This demand includes 632 long-term and 160 short-term spaces. By the year 2000, 1,911 spaces are estimated to be required to meet the demands of the full-build scenario of the proposed development, including 1,495 long-term and 416 short-term spaces.

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[4] Parking in Central Boston: Meeting the Access Needs of a Growing Downtown, Cambridge Systematics, Inc. and Vanasse Hangen Associates, December 1983.

Table IV-A-41 **COMMERCIAL COMPONENT PARKING DEMAND***

	1995	2000
Short-term	160	416
Long-term	632	1,495
TOTAL	792	1,911

* Peak midday demand.

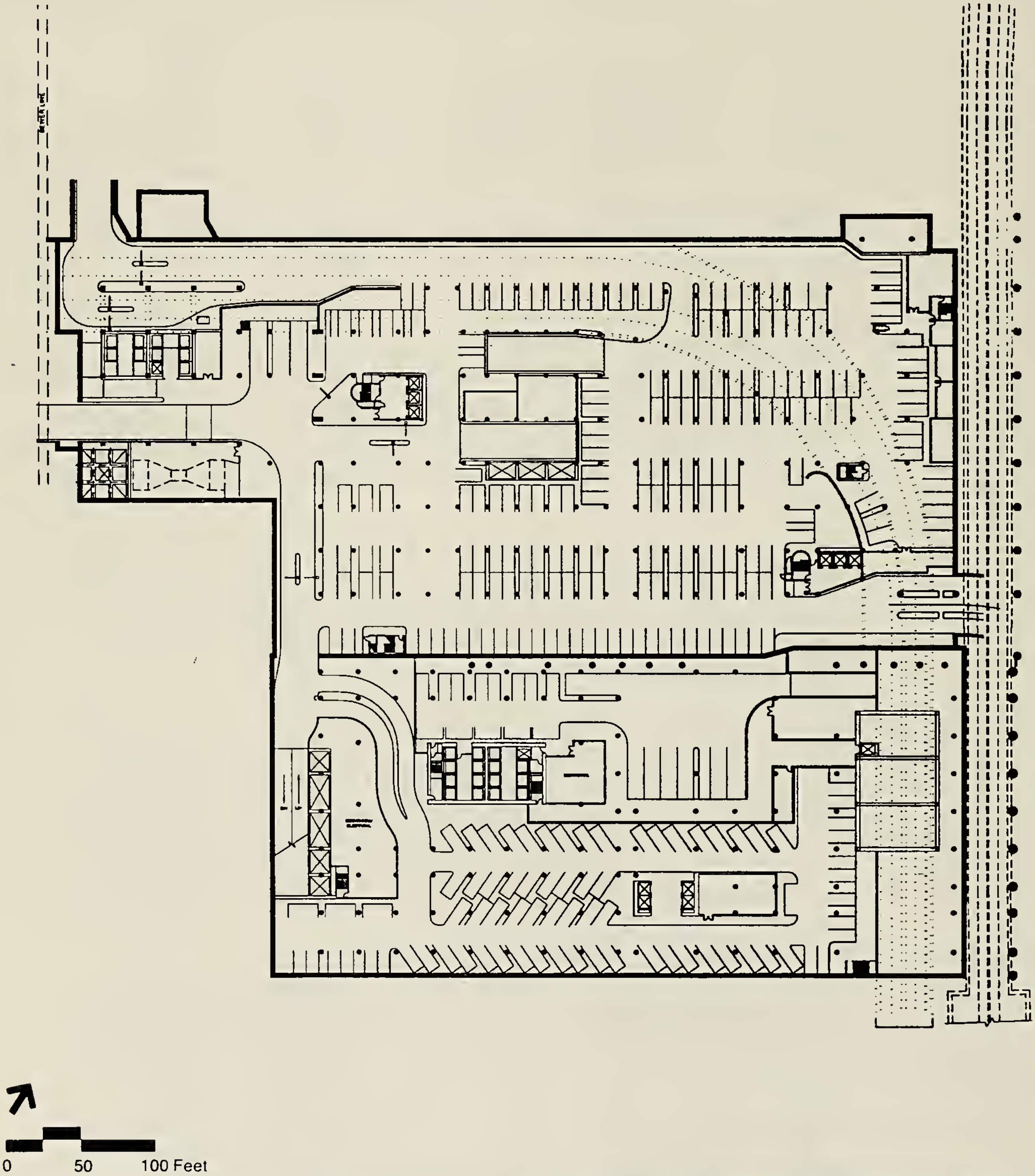
Project Parking Plan

The New Boston Garden Development Garage is proposed as a six-level underground parking facility containing 1,100 parking spaces. It will be constructed immediately adjacent to the 1,300-space MBTA parking facility which is currently under construction. Figures IV-A-25 and IV-A-26 provide illustrations of the layout of a typical level of the two garages. The two garages will be designed and operated in a coordinated manner to improve efficiency and safety.

The typical parking stall measures 18 feet in length by 9 feet in width. On each level there is a combination of 90-degree stalls on each end and 45-degree stalls along the length of the layout. One-way circulation aisles measuring 18 feet in width are provided, resulting in a typical parking module width of 44 feet. Ramps are located on the western end of the project Garage and in the interior of the MBTA garage.

The MBTA garage will provide two points of vehicular access, each accommodating ingress and egress movements. Figure IV-A-27 shows the access points to the garage. An entrance/exit driveway is located on frontage to Causeway Street and separate entrance and exit driveways are located on Nashua Street. Each drive will provide three gates for payment and two travel lanes. The gate arrangement will vary depending upon time of day, with a minimum of two gates in the off-peak direction at all times during the day, and a maximum of six outbound gates during the hour after an event. Access to the project Garage is provided via the MBTA garage at Levels 1 and 2.

The driveway next to Causeway Street will be a two-lane, two-way roadway. During regular business hours, the drive will operate as a two-way roadway. In the year 2000, during the peak exiting period in the afternoon, pedestrian-vehicle flows will be managed by a proposed traffic signal at the intersection of the garage entrance/exit, Causeway Street, and the Surface Artery Southbound. While no exclusive pedestrian phase is proposed for this signal, individual pedestrian movements will be permitted during individual phases of the traffic signal. During the peak hour after an event, the drive will operate as a one-way roadway with traffic flowing in both lanes in the outbound direction. The intersection at Causeway Street will be police-officer controlled, and pedestrian movements--most of which will be concentrated on the west side of the intersection where the MBTA stations will be located--will be managed by the police officer.



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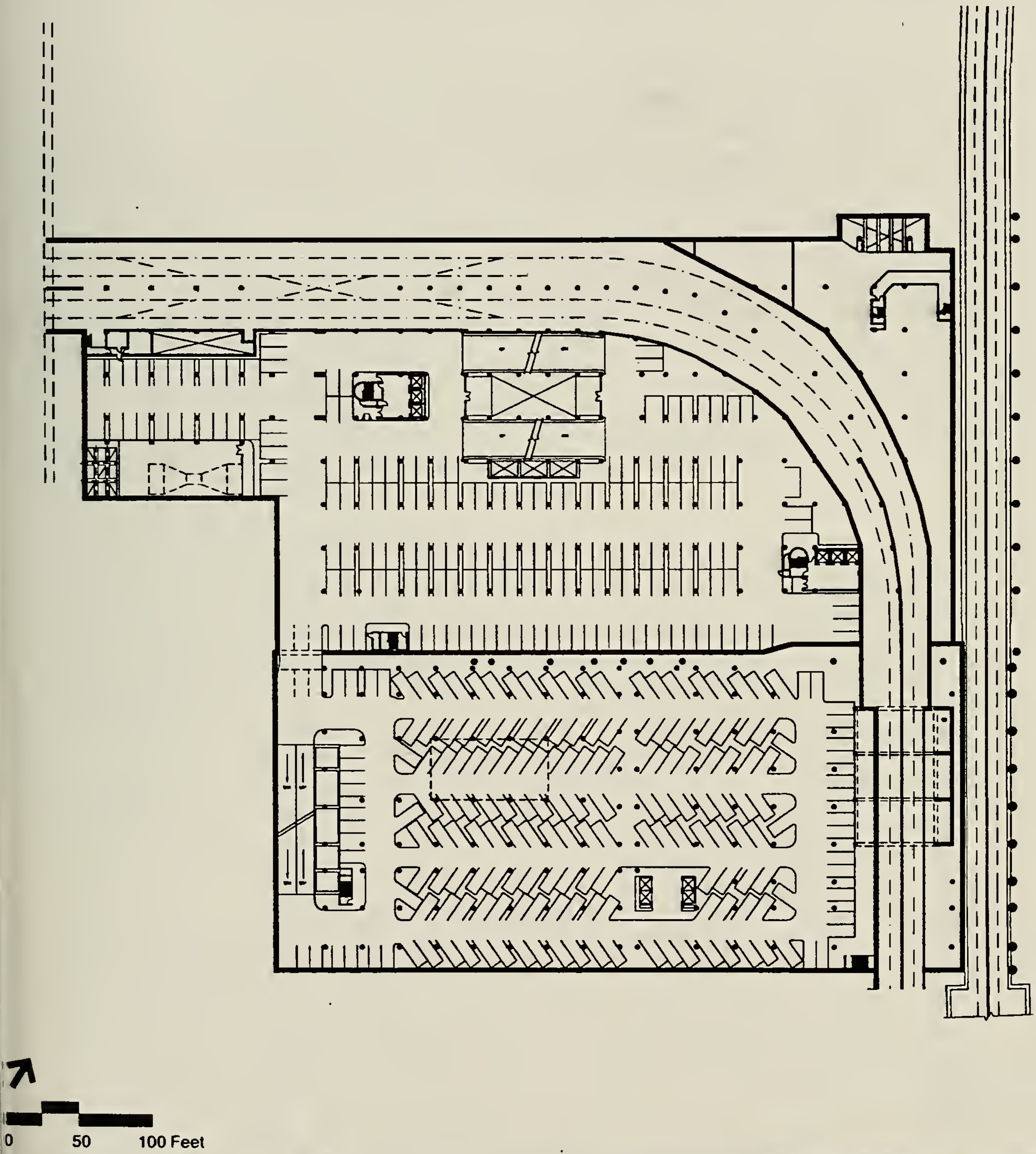
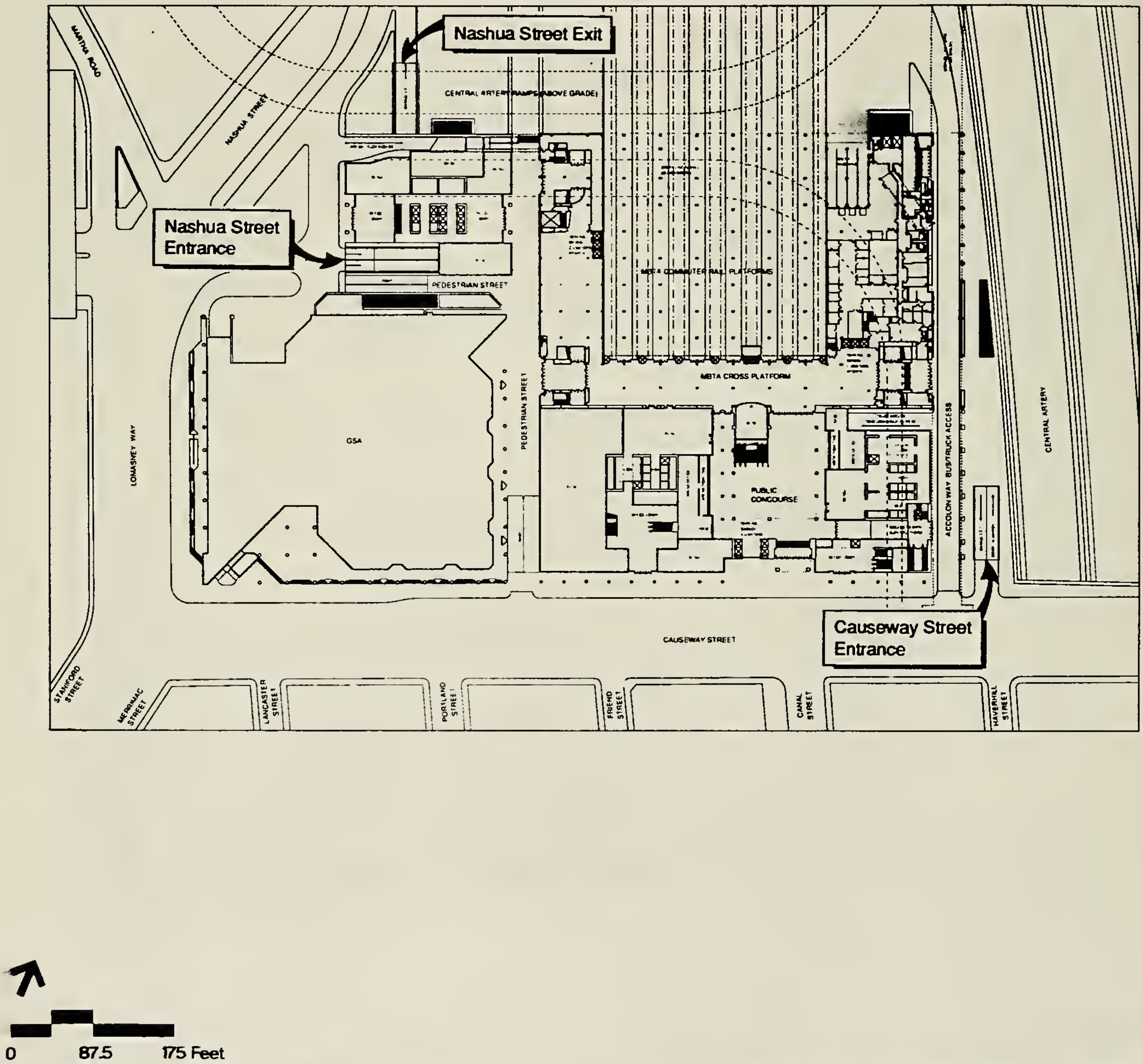
Parking Level One

Figure IV-A-25



Parking Plan–
Typical Floor Layout

Figure IV–A–26



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Garage Access

Figure IV-A-27

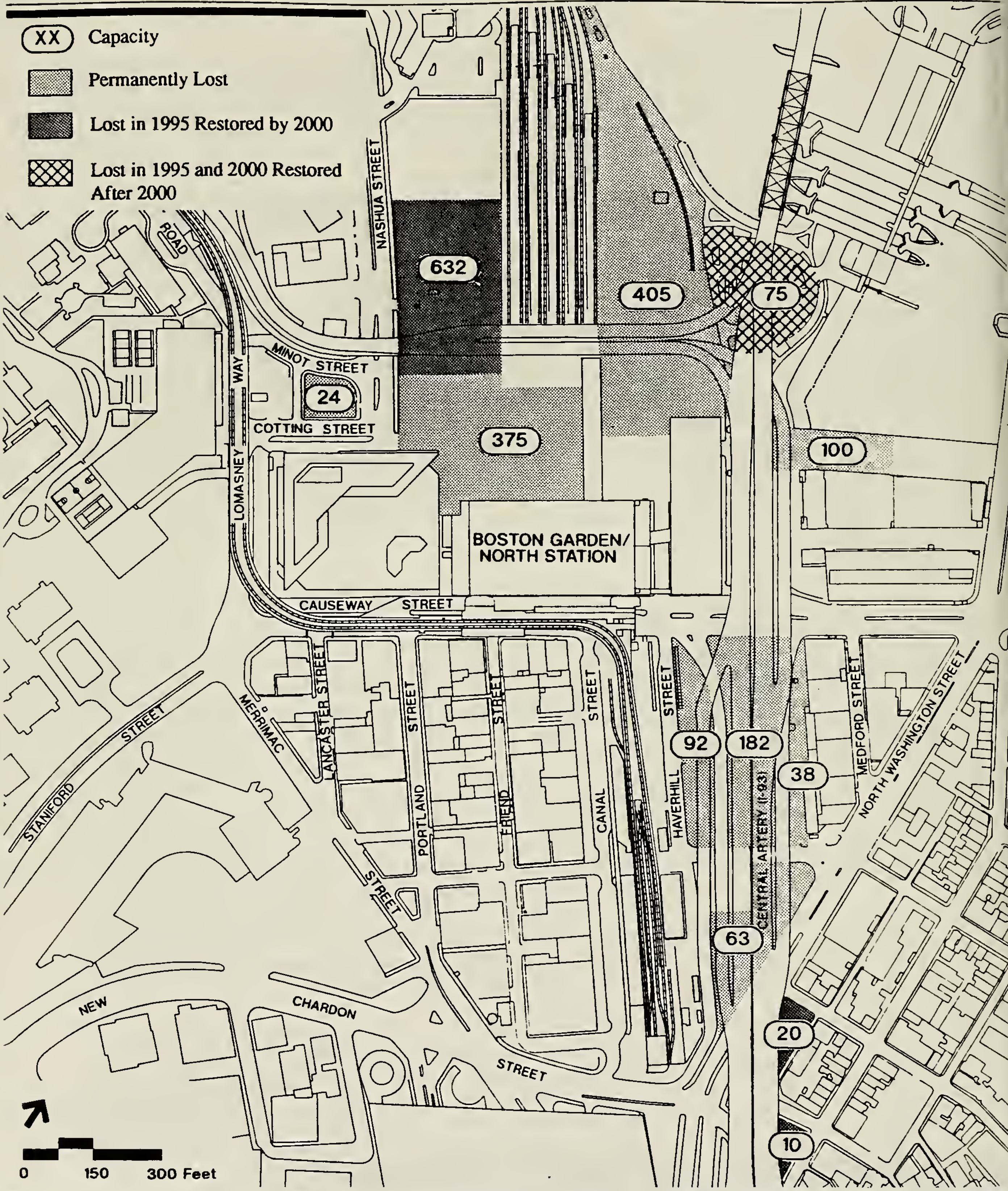
On the Nashua Street side of the parking garage, the entrance driveway is separate from the exit driveway. Each of the driveways is two lanes wide with one-way traffic flow. Pedestrian crosswalks and sidewalks have been proposed in such a way as to minimize conflicts with vehicles. One crossing is situated at the intersection of the entrance drive with Lomasney Way, Nashua Street, and Martha Road and will be controlled by a traffic signal except after Boston Garden events, when there will be police officer control. Another crossing is directly in front of the exit drive. At the intersection of the exit drive with Nashua Street, Nashua Street widens from two lanes to three lanes in the northbound direction.

Because access/egress to the project Garage will be via the MBTA garage, these two garages are planned to function as a single operating entity. That is, the facilities will be jointly managed with comparable rate structures, hours of operation, and other related management procedures. Tenants of the project office development will be allocated 900 spaces in the project Garage. Reserved monthly spaces and public daily and hourly spaces will be provided in each facility. To the extent possible, parkers will be directed to use the appropriate facility, minimizing walking distance from the parking location to the parker's destination. For New Boston Garden events, approximately 950 spaces will be reserved for purchasers of executive suites and club seats.

Areawide Supply and Demand

Significant changes to the existing parking supply are anticipated in the near future. By 1995, the reconstruction of the Central Artery will displace 1,692 parking spaces that currently are part of the North Station area supply. It is estimated that 582 of these spaces will be lost only temporarily, and between 1995 and 2000, these 582 spaces will be returned to the supply. In addition to the loss of spaces due to Central Artery reconstruction, the MBTA's planned Green Line relocation will permanently displace an additional 484 spaces by 1995. In an effort to replace parking spaces lost due to the Central Artery reconstruction and the Green Line relocation projects, the MBTA has started construction of a 1,300-space underground parking garage just north of the existing Boston Garden. In addition, Parcel 7, just south of the existing Government Center Garage, is planned for a garage of approximately 340 spaces, which are also intended to replace lost spaces. Both the MBTA North Station garage and the Parcel 7 garage are expected to be open by the 1995 analysis year. Figure IV-A-28 shows the location of parking facilities which will be lost and those that will be constructed or replaced.

The net change in parking supply for both analysis years (1995 and 2000) is presented in Table IV-A-42. The majority of the parking supply changes take place by the 1995 analysis year when a net loss of 536 spaces is anticipated in the study area. Between 1995 and 2000 no additional spaces will be lost and some parking spaces temporarily lost due to the Central Artery reconstruction will be replaced, for a net gain of 46 spaces in the study area.



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Anticipated Parking Supply Changes

Figure IV-A-28

Table IV-A-42 PROJECTED PARKING SUPPLY CHANGES

Project	Supply Changes By 1995 Built	Lost	Net Change
Central Artery*	0	-1,692	-1,692
MBTA Green Line Extension**	0	-484	-484
MBTA Garage**	1,300	0	1,300
Parcel 7	340	0	340
NET CHANGE BY 1995	1,640	-2,176	-536

Project	Supply Changes Between 1995 and 2000 Built	Lost	Net Change
Central Artery*	582	0	582
NET CHANGE BETWEEN 1995 AND 2000	582	0	582
NET CHANGE BY 2000	2,222	-2,176	46

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* Central Artery (I-93)/Third Harbor Tunnel (I-90) Project, Draft Supplemental EIS/EIR; Massachusetts Department of Public Works, May 1990.

** MBTA North Station Underground Garage, Final Traffic Impact Assessment; Parsons Brinckerhoff/Seelye Stevenson, January 1990.

As discussed in the background development section of the report, three specific projects are anticipated to be developed in the North Station area by 1995. Three additional projects are expected to be built between 1995 and 2000. The planned parking supply as well as the parking demand associated with these developments is presented in Table IV-A-43. The parking demand for background developments was projected using the same vehicle trip generation factors and parking turnover rates used for the commercial component of the proposed New Boston Garden Development.

Table IV-A-43

1995 AND 2000 BACKGROUND DEVELOPMENT PARKING DEMAND

Proposed Development	Supply	Demand	Supply - Demand
101 Merrimac Street	70	140	-70
251 Causeway Street	0	140	-140
1 Congress Street	0	230	-230
1995 Subtotal	70	510	-440
Portland Place	159	104	+55
Mass. General Hospital	150	318	-168
Lowell Square	*	*	*
2000 TOTAL	379	932	-553

* The parking supply for this project is assumed to meet all on-site demands only.

As a result of the background projects expected to come on line by 1995, an additional parking demand of 510 spaces will result. Of these 510 spaces, 70 will be accommodated on the 101 Merrimac Street site, resulting in a net increase in areawide parking demand of 440 spaces. By 2000, an additional parking demand of 932 spaces will result from the proposed developments, 379 spaces of which will be met by on-site supply for a net increase in areawide parking demand of 553 spaces.

Table IV-A-44 summarizes the changes in areawide supply and demand from existing to 1995 and 2000 No-Build conditions. Between now and 1995, a decrease in supply coupled with an increase in demand results in a shift from a surplus of 500 spaces to a deficit of 476 spaces. By the year 2000, the deficit is reduced to an insignificant number of spaces (seven spaces) because of the restoration of spaces temporarily lost to Central Artery construction.

Table IV-A-44

NO-BUILD AREAWIDE PARKING SUPPLY AND DEMAND

Analysis Condition	Supply	Demand	Surplus/Deficit
Existing	9,998	9,498*	500
Existing to 1995 Change	-466	+510	
1995 NO-BUILD	9,532	10,008	(476)
1995 to 2000 Change	+891	+422	
2000 NO-BUILD	10,423	10,430	(7)

* Assumes 95 percent occupancy as indicated in 1987 BTD downtown parking inventory. Includes additional parking facilities not included in 1987 inventory.

Future Parking Conditions

Table IV-A-45 presents the 1995 and 2000 analysis year parking conditions at the midday peak demand point in the North Station area. As shown, under the 1995 No-Build condition, a deficit of 476 spaces results. The 1995 No-Build deficit is primarily due to the loss of parking spaces in the area resulting from construction of the Central Artery and MBTA Green Line relocation as well as increased parking demand from additional background development projects.

Under the 1995 Build condition, the parking deficit reduces to 168 spaces from 476 in the No-Build condition. This is because the proposed New Boston Garden Development has a parking surplus of 308 spaces in 1995. It is expected that the surplus parking in the project's garage will be available for public parking as a measure to help mitigate the temporary parking deficit resulting from Central Artery reconstruction.

Table IV-A-45 **1995 AND 2000 PARKING CONDITIONS**

Year	Supply	Peak Demand*	Surplus/Deficit
Existing	9,998	9,498**	500
1995:			
1995 No-Build***	9,532	10,008	-476
1995 Project-Related	1,100	792	308
1995 Interim-Build	10,632	10,800	-168
2000:			
2000 No-Build***	10,423	10,430	-7
2000 Project-Related	1,100	1,911	-811
2000 Full-Build	11,523	12,341	-818

* Peak demand at noon (weekday).

** Assumes 95 percent occupancy as indicated in 1987 BTD downtown parking inventory. Includes additional parking facilities not included in 1987 inventory.

*** Includes background projects and existing supply.

Under the 2000 No-Build condition, a parking deficit of 7 spaces results. The year 2000 parking deficit is not as severe as the 1995 deficit because almost 600 spaces will be reconstructed by the commonwealth upon completion of the Central Artery project. Under the 2000 Build condition, the parking deficit increases to 818 spaces on an areawide basis. The areawide deficit would increase pressure on drivers to shift to transit or ridesharing. Because transit usage is currently high, the largest shift would likely be to ridesharing. A modest increase in VOR from the current level of 1.4 persons per vehicle to 1.5 would eliminate most of the deficit. This higher VOR would still be lower than the level reported for many financial district office buildings.

Public Transportation

The public transportation analysis focused on the impact of the total project on the evening commuter peak hour because public transportation system demand is greatest at that hour. The impact of the arena on the evening pre-event peak hour was also assessed. The analysis concentrated on the rapid transit system, which is expected to carry the majority of project transit trips. Rapid transit system impacts are critical because capacity increases are more difficult to implement on rapid transit systems than on bus and commuter rail systems. As explained in the Existing conditions section of this report, public transportation capacity analysis centers on the number of passengers carried on each route's highest ridership ("peak load") segment in the dominant ("peak") direction of travel. If a proposed project significantly impacts the public transportation system, the impacts occur on the peak load segments, even if they are far from the project site. In this section of the report, the expected future capacity of the rapid transit system is compared with forecast evening peak hour, peak direction ridership on the peak load segments.

Future Capacity

The Massachusetts Bay Transportation Authority (MBTA) has an ongoing program of capacity expansions and service improvements. By lengthening subway platforms and expanding vehicle fleets, the MBTA can accommodate longer trains without reducing frequency. As a result of this expansion program, the evening peak hour planning capacity of the MBTA rapid transit system is expected to increase significantly between now and 2000. According to the MBTA Operations Department, by 1995, all peak hour trains on the Red and Orange lines will operate with six cars at existing frequencies. Also by 1995, average train lengths are expected to increase to five cars on the Blue Line and to two cars on the Green Line/West. These changes increase the total planning capacity of each line as shown in Table IV-A-46. Capacity increases planned for 2000 reflect an increase in the number of cars per train and the number of trains per hour. Train lengths will be increased on the Green Line/West and on the Blue Line, while the Red and Orange lines will operate at higher frequencies (see Table IV-A-47).

Table IV-A-46 **1995 RAPID TRANSIT LINE CAPACITY - EVENING PEAK HOUR, PEAK DIRECTION***

Line/Segment	Average Cars/ Train	Average Headway (minutes)	Average No. of Trains	Planning Capacity of Car**	Planning Capacity of Line
Orange Line/North-South Oak Grove-Forest Hills	6.0	4.5	13.3	155	12,400
Green Line/West Boston College Cleveland Circle Riverside Huntington Avenue	2.0	1.3	46.0	130	11,960
Green Line/North Lechmere Service	2.0	8.0	7.5	130	1,950
Red Line/North Ashmont-Alewife Braintree-Alewife	6.0	4.0	15.0	180	16,200
Red Line/South Alewife-Ashmont Alewife-Braintree	6.0	3.5***	17.0	180	18,360
Blue Line Bowdoin-Wonderland	5.0	3.2	19.0	110	10,450

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* Based on maintaining existing headways and increasing train lengths (as planned by the MBTA).

** The MBTA uses these capacity estimates for planning purposes. Heavier loads can be carried and are often observed on the system.

*** Southbound service is more frequent than northbound because two additional southbound trains are scheduled during the peak hour.

Table IV-A-47 **2000 RAPID TRANSIT LINE CAPACITY - EVENING PEAK HOUR, PEAK DIRECTION***

Line/Segment	Average Cars/ Train	Average Headway (minutes)	Average No. of Trains	Planning Capacity of Car**	Planning Capacity of Line
Orange Line/North-South Oak Grove-Forest Hills	6.0	4.0	15.0	155	13,950
Green Line/West Boston College Cleveland Circle Riverside Huntington Avenue	2.4	1.3	46.0	130	14,350
Green Line/North Lechmere Service	2.0	8.0	7.5	130	1,950
Red Line/North Ashmont-Alewife Braintree-Alewife	6.0	3.0	20.0	180	21,600
Red Line/South Alewife-Ashmont Alewife-Braintree	6.0	3.0	20.0	180	21,600
Blue Line Bowdoin-Wonderland	6.0	3.5	17.0	110	11,220

* Forecasts based on discussions with the MBTA Operations Department.

** The MBTA uses these capacity estimates for planning purposes. Heavier loads can be carried and are often observed on the system.

1995 and 2000 No-Build Ridership

Table IV-A-48 presents the existing and projected 1995 and 2000 No-Build ridership levels on the rapid transit system's seven peak load segments. The rapid transit ridership projected for 1995 and 2000 No-Build conditions includes all expected increases in ridership due to projected growth in Boston and Cambridge, not including the New Boston Garden Development. These projected ridership levels for 1995 and 2000 were developed for the Prudential Center Redevelopment Draft Project and Environmental Impact Report.[5] (Projected ridership for 1995 and 2000 conditions have been slightly modified from the Prudential report based on the most recent ridership data presented in the Existing Conditions section of this chapter.) The specific development projects included in the 1995 forecast are listed in the Technical Data appendix. Since specific projects for the 1995 to 2000 period are not known, the forecast for this period was derived in the Prudential report by assuming that the annual increase during the years from 1995 to 2000 is the same as the annual increase during the years from 1988 to 1995.

5/ Prudential Center Redevelopment Draft Project and Environmental Impact Report, Volume IV: Transportation Access Plan, Vanasse Hangen Brustlin, Inc., April 1989.

Table IV-A-48 RAPID TRANSIT RIDERSHIP - EXISTING, 1995 NO-BUILD, AND 2000 NO-BUILD CONDITIONS*

Rapid Transit Line/ Direction (Peak Load Segment)	Ridership Existing	1995**	2000**
Orange Line/North (Haymarket-North Station)	8,400	11,120	13,350
Orange Line/South (N.E. Medical Center-Back Bay Station)	7,600	10,000	11,990
Green Line/West (Arlington-Copley)	10,100	11,690	13,940
Green Line/North (Science Park-Lechmere)	1,250	1,510	1,695
Red Line/North (Kendall-Central)	7,400	10,450	12,935
Red Line/South (Broadway-Andrew)	9,500	13,930	17,455
Blue Line/North (Aquarium-Maverick)	6,300	7,860	9,175
TOTAL	50,550	66,560	80,540

* Evening peak hour, peak direction.

** Projected ridership for 1995 and 2000 No-Build conditions has been modified from the Prudential Center Draft EIR/PIR based on the most recent ridership count conducted in the Spring of 1989 by CTPS.

Project Impacts on Public Transportation

Table IV-A-59 projects the number of peak hour transit trips generated by the New Boston Garden Development in 1995 and 2000. Approximately 1,090 new morning peak hour trips and approximately 1,000 new evening peak hour trips in 1995 are expected. Approximately 2,570 new morning peak hour trips and about 2,310 new evening peak hour trips are expected in 2000.

Table IV-A-49 1995 AND 2000 PROJECT PUBLIC TRANSPORTATION TRIPS*

	1995	2000
Morning Peak Hour:		
In	1,086	2,560
Out	3	11
TOTAL	1,089	2,571
Evening Peak Hour:		
In	81	113
Out	922	2,200
TOTAL	1,003	2,313

* All modes of public transportation.

Table IV-A-50 shows the expected breakdown of project riders to the three modes of public transportation. This breakdown is based on current ridership.

Table IV-A-50

ASSIGNMENT OF PROJECT VOLUMES TO MODES OF PUBLIC TRANSPORTATION

Mode	Percent of Public Transportation Trips*	Evening Peak Hour Departing Trips 1995	Evening Peak Hour Departing Trips 2000
Bus	14%	140	324
Commuter Rail	20%	201	463
Rapid Transit	66%	662	1,526
TOTAL	100%	1,003	2,313

* Based on current ridership.

Current ridership figures are also used to allocate project rapid transit trips to the seven peak load segments of the rapid transit system. Table IV-A-51 indicates the percentage projected to use each rapid transit line, as well as the number of evening peak hour outbound trips expected on the peak load segments.

The impact of the New Boston Garden Development on the rapid transit system's peak load segments is expected to be small (no more than 1 percent of planning capacity in 1995 and no more than 2 percent of planning capacity in 2000). Total ridership on all peak load segments is expected to be at or below planning capacity in the evening peak hour in 1995 (see Table IV-A-52) and in 2000 (see Table IV-A-53). Thus, the project and background development rapid transit trips can be carried at acceptable levels of service.

Table IV-A-51 PROJECT EVENING PEAK HOUR RAPID TRANSIT TRIPS ON PEAK LOAD SEGMENTS

Line/Direction (Peak Load Segment)	Distribution Percentage	Passengers 1995	Passengers 2000
Orange Line/North (Haymarket-North Station)	17%	0*	0*
Orange Line/South (N.E. Medical Center-Back Bay Station)	14%	93	214
Green Line/West (Arlington-Copley)	17%	113	259
Green Line/North (Science Park-Lechmere)	2%	13	23
Red Line/North (Kendall-Central)	15%	99	229
Red Line/South (Broadway-Andrew)	24%	159	366
Blue Line/North (Aquarium-Maverick)	11%	73	168
TOTAL	100%	550	1,267

* The riders expected to use the Orange Line/North (112 in 1995 and 259 in 2000) board northbound trains at North Station and, therefore, do not impact the peak load segment.

Table IV-A-52 1995 RAPID TRANSIT RIDERSHIP AND CAPACITY - EVENING PEAK HOUR

Line/Segment	1995 Planning Capacity	1995 No-Build Ridership	1995 No-Build Percent of Capacity	1995 Build Ridership	1995 Build Percent of Capacity
Orange/North	12,400	11,120	90%	11,120	90%
Orange/South	12,400	10,000	81%	10,093	81%
Green/West	11,830	11,690	98%	11,803	99%
Green/North	1,950	1,510	77%	1,523	78%
Red/North	16,200	10,450	65%	10,549	65%
Red/South	18,360	13,930	76%	14,089	77%
Blue/North	10,450	7,860	75%	7,933	76%

Table IV-A-53 2000 RAPID TRANSIT RIDERSHIP AND CAPACITY - EVENING PEAK HOUR

Line/Segment	2000 Planning Capacity	2000 No-Build Ridership	2000 No-Build Percent of Capacity	2000 Build Ridership	2000 Build Percent of Capacity
Orange/North	13,950	13,350	96%	13,350	96%
Orange/South	13,950	11,990	86%	12,204	88%
Green/West	14,300	13,940	97%	14,199	99%
Green/North	1,950	1,695	87%	1,726	89%
Red/North	21,600	12,935	60%	13,164	61%
Red/South	21,600	17,455	81%	17,821	83%
Blue/North	11,220	9,175	82%	9,343	83%

Impacts on the commuter rail and bus systems are likewise expected to be minor. During the evening peak hour in 1995, approximately 200 new commuter rail riders and approximately 140 new bus riders (three additional buses) are expected to depart from the site. In 2000, approximately 465 new commuter rail riders and about 325 new bus riders (six additional buses) are expected to depart from the site during the evening peak hour.

A 72 percent increase in commuter rail service capacity is expected by 2000. This increase is due to the expansion of the fleet with double-deck coaches. The increase in commuter rail ridership associated with the New Boston Garden Development is minimal compared with both the existing and projected future commuter rail capacity. Likewise, the increase in bus ridership associated with the New Boston Garden Development is minimal in comparison with existing bus service capacity.

Arena Impacts on Public Transportation

The previous section analyzed the impact of the project, including the commercial component and arena, on the peak load segments of the transit system during the peak commuter hours. However, there is the potential for arena impacts on a different segment of the transit system just prior to an arena event. Table IV-A-54 presents the expected increase in public transportation ridership due to the expansion of the arena.

Table IV-A-54 **PUBLIC TRANSPORTATION TRIPS GENERATED BY ARENA EXPANSION***

Time Period	Existing Trips	Net New Trips
Daily:		
In	3,929	507
Out	3,929	394
TOTAL	7,858	901
Evening Peak Hour:		
In	557	68
Out	0	0
TOTAL	557	68
Pre-Event Peak Hour**:		
In	1,698	220
Out	0	0
TOTAL	1,698	220

* All modes of public transportation.
** 6:00 PM to 7:00 PM (based on arena event survey results).

Unlike the commercial component of the project, the location and time period of most concern to the MBTA Operations Department when considering arena impacts on the transit system is the Green Line segment between Haymarket and North Station just prior to an event. To assess the impacts of arena-generated transit trips, ridership counts were conducted on the Green Line northbound segment between Haymarket and North Station on three event nights. Table IV-A-55 presents the results of these ridership counts and shows a comparison of existing capacity available on this link. Although not all arena-generated transit trips will use this segment of the Green Line, the available capacity on this segment in the pre-event peak hour (6:00 and 7:00 PM), would be sufficient to accommodate the total increase in transit ridership associated with the replacement of the arena.

Table IV-A-55 GREEN LINE SERVICE AND RIDERSHIP - EVENING PEAK HOUR OUTBOUND DEPARTING FROM HAYMARKET STATION

Date/Time	Planning Capacity	Ridership	Unused Capacity
10/26/89:			
4:00-5:00 PM	4,550	1,520	3,030
5:00-6:00 PM	4,420	1,630	2,790
6:00-7:00 PM	4,290	900	3,390
7:00-8:00 PM	2,080	860	1,220
11/2/89:			
4:00-5:00 PM	5,590	1,540	4,050
5:00-6:00 PM	4,680	1,500	3,180
6:00-7:00 PM	4,290	930	3,360
7:00-8:00 PM	2,080	880	1,200
11/15/89:			
4:00-5:00 PM	5,720	1,550	4,170
5:00-6:00 PM	4,420	1,400	3,020
6:00-7:00 PM	4,420	1,490	3,630
7:00-8:00 PM	2,470	790	1,680

Pedestrians

This section describes future project site circulation and presents a detailed analysis of walkway and crosswalk levels of service during commuter peak hours. A discussion of pre-event conditions is also presented but no detailed analysis is included because the pedestrian environment is expected to be improved during the pre-event peak hour.

Site Circulation

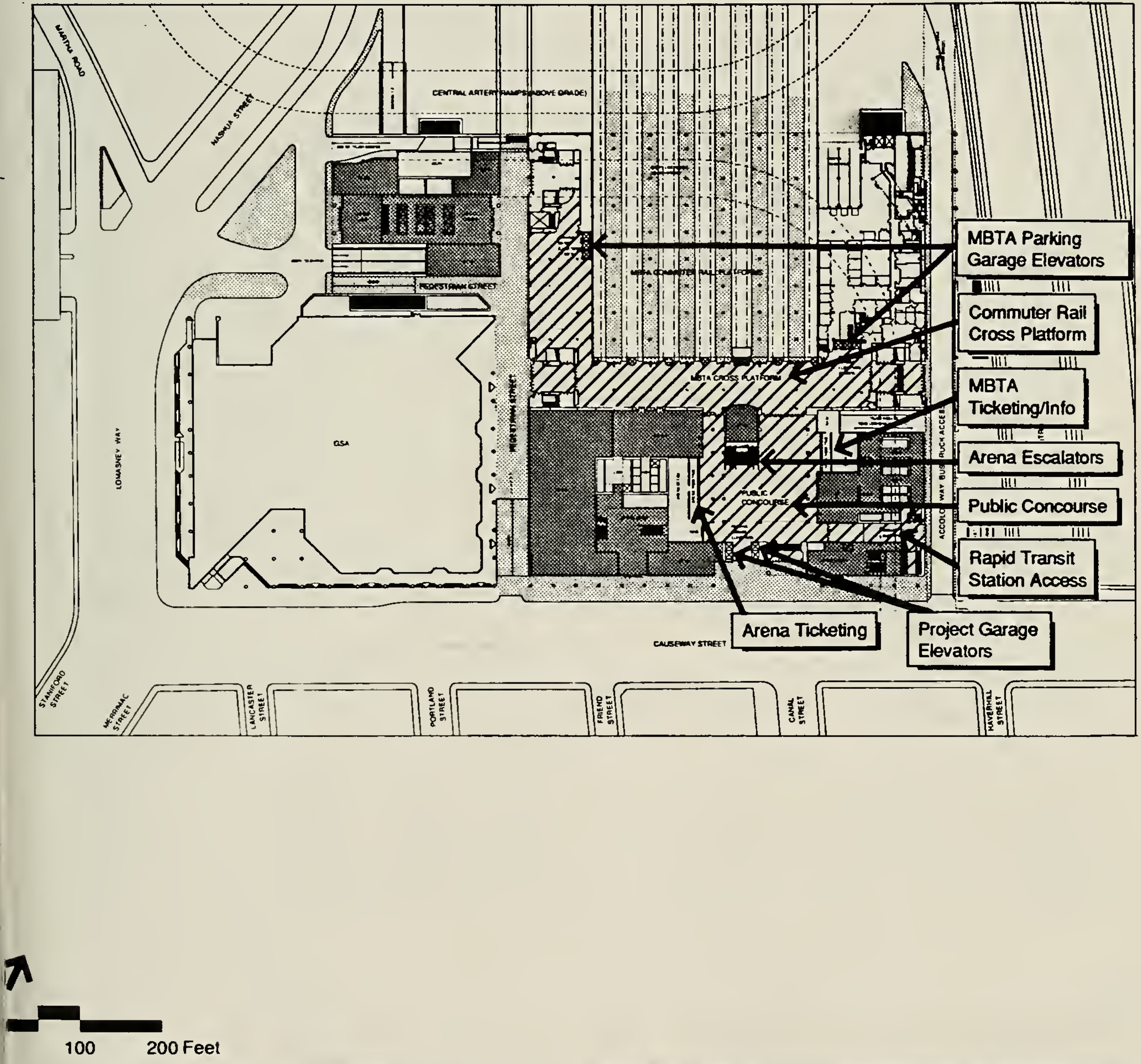
Figures IV-A-29 and IV-A-30, respectively, illustrate the on-site pedestrian areas and pathways proposed for the New Boston Garden Development. As shown, the proposed site plan provides a greatly enhanced interior pedestrian environment. The Public Concourse provides access to the entire development including commuter rail service, rapid transit service, MBTA and arena ticketing, retail space, and office space.

The New Boston Garden Development also provides a greatly enhanced exterior pedestrian environment. Pedestrian walkways adjacent to the site will vary in width from 20 to 40 feet. The walkway in front of the main entrance to Boston Garden will be widened from 15 to 25 feet, allowing more room for pedestrian activity.

░ Outdoor Pedestrian Areas

▨ Indoor Pedestrian Areas

▩ Retail Areas and Office Lobbies



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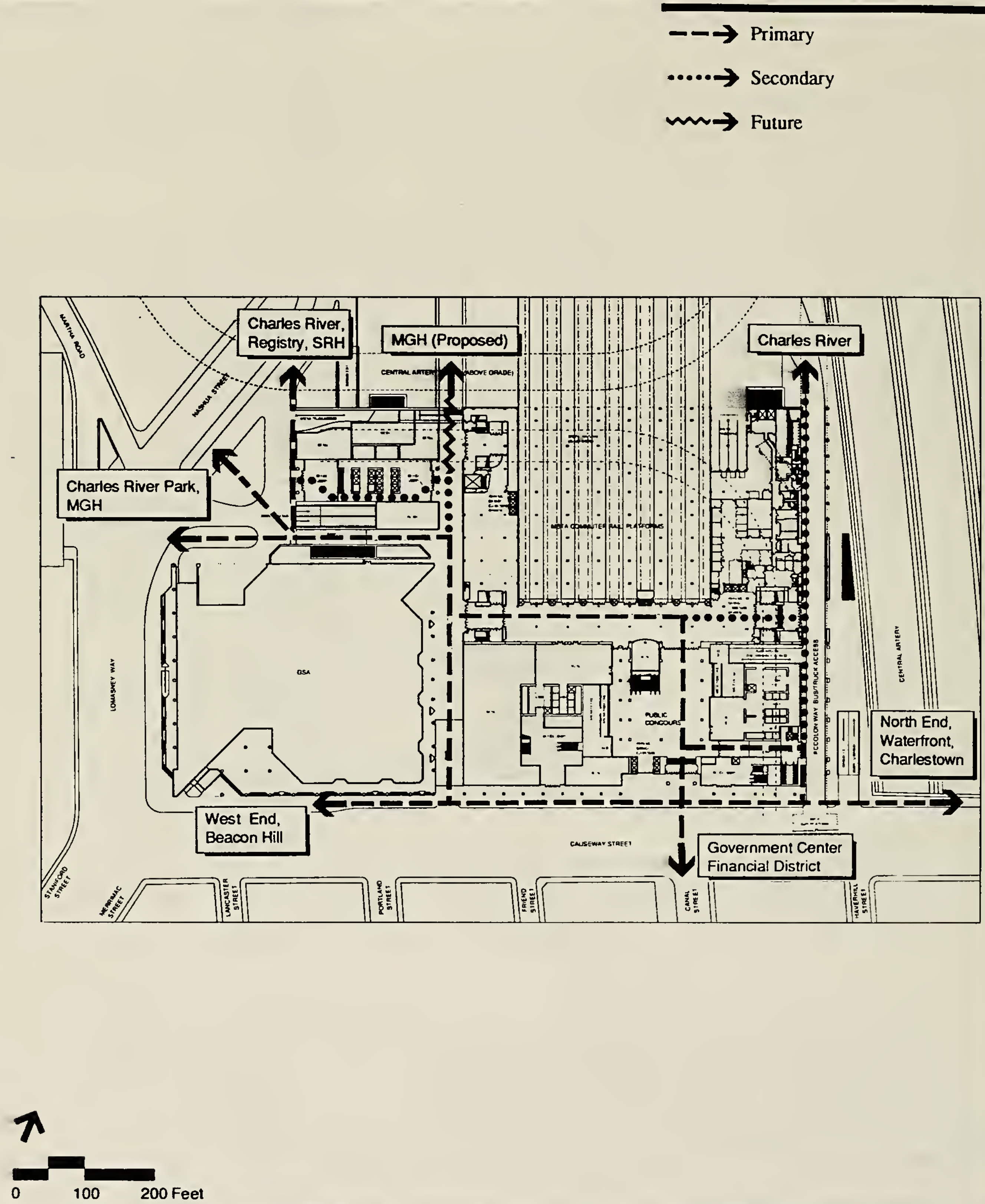
Pedestrian Areas

Figure IV-A-29



Pedestrian Pathways

Figure IV-A-30

In addition to changes in pedestrian corridors resulting from the New Boston Garden Development, there also are other North Station modifications that impact pedestrian access. As a result of modifications to the MBTA Green and Orange Lines, access to these rapid transit lines will be provided at both the existing entrance on the south side of Causeway Street between Canal and Haverhill Streets and on the north side of Causeway Street from inside the project's Building C. Therefore, MBTA riders who make the connection between North Station commuter rail lines and the rapid transit lines will no longer be required to exit North Station and cross Causeway Street to gain access to the subway. The same is true for movements in the reverse direction. As a result, the volume of pedestrians crossing Causeway Street at Canal Street will be reduced. This creates a more convenient and safer pedestrian link between the Green and Orange Lines and North Station, and reduces the number of pedestrian-vehicle conflicts on Causeway Street.

Arena Pre-Event Peak Hour Pedestrian Trip Generation

The arena is expected to generate new pedestrian trips principally during pre-event peak hours. A formal level-of-service analysis for the pre-event peak hour is not necessary because changes in site conditions should serve to reduce pedestrian volumes approaching the site compared to existing conditions. The number of additional patrons generated by the expanded arena will be approximately 3,475, roughly equal to the number of new seats.[6] Under existing site conditions, all new patrons would generate pedestrian trips on adjacent walkways and crosswalks. The increase in on-site parking and opening of transit entrances on-site will result in a reduction of pedestrian trips greater than the increase due to additional seating.

The first change is an increase in on-site parking of 2,025 spaces from the MBTA garage and the project Garage. Boston Garden patrons who park on-site will not need to use adjacent walkways or crosswalks to enter the arena. At an average of 2.25[7] people per vehicle, these 2,025 additional spaces will remove 4,550 pedestrians from the area. Pedestrian volumes will be further reduced by the provision of an Orange Line and Green Line station entrance on the southeast corner of the site in Building C. This means that the approximately 1,900 Boston Garden patrons using transit can enter the arena without using adjacent walkways and crosswalks. These decreases in pedestrians approaching the arena are expected to offset any increases due to expanded seating. This, combined with widening of walkways, will result in equal or improved levels of service compared to existing conditions. Due to these expected improvements formal analysis of pre-event peak hour pedestrian conditions is not warranted.

Commercial Component Pedestrian Trip Generation

Walk trips generated by the project were presented earlier in the Future Travel Demand section of the report. Net new project pedestrian trips are shown in Table IV-A-56. Walk trips are those made entirely on foot. Pedestrian trips also usually include transit trips made to off-site stations, but transit trips generated by the project do not add any pedestrian volume adjacent to the site because rapid transit stations and commuter rail service are internal to the site. In the case of the New Boston Garden Development, a 308-space parking surplus in the project Garage in 1995 will result in additional pedestrian trips from parkers using the garage destined for off-site locations. Those pedestrian trips will add volume to walkways and crosswalks adjacent to the site. In 2000, some project-related parkers are expected to walk to the site from off-site parking facilities.

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[6] Executive suites and club seats for a basketball game.

[7] Existing vehicle occupancy rate for skybox patrons.

Table IV-A-56 **NET NEW PROJECT PEDESTRIAN TRIPS**

	1995			2000		
	Walk	Parkers*	Total	Walk	Parkers**	Total
Morning Peak Hour:						
In	124	14	138	294	401	695
Out	8	153	161	23	37	60
TOTAL	132	167	299	317	438	755
Evening Peak Hour:						
In	25	116	141	74	243	317
Out	114	92	206	298	304	602
TOTAL	139	208	347	372	547	919

* Resulting from on-site parking being utilized by other North Station area commuters due to project parking surplus.

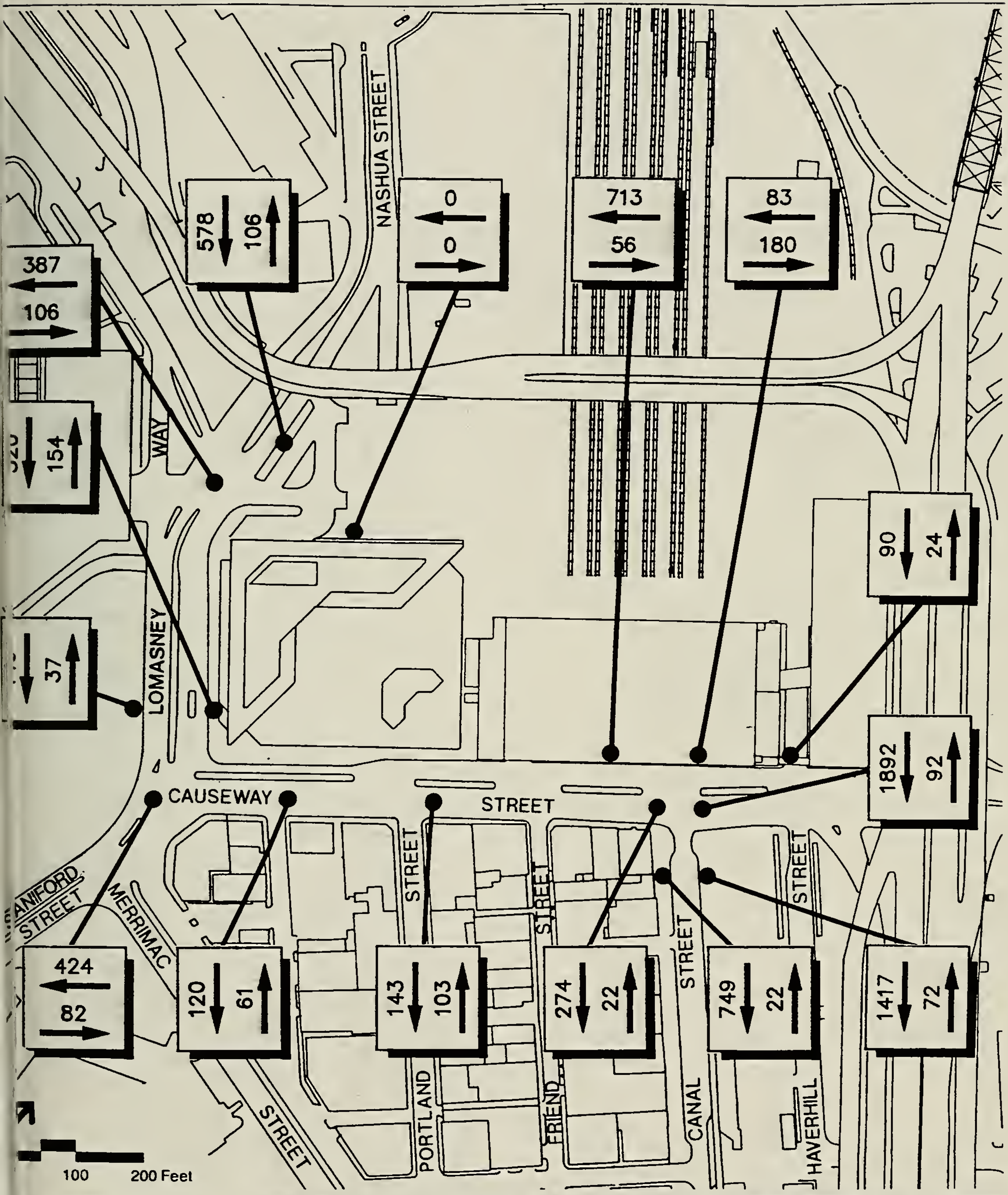
** Resulting from New Boston Garden Development commuters parking off-site due to project parking deficit.

As shown in Table IV-A-56, the project is expected to generate approximately 300 pedestrian trips during the morning peak hour in 1995. In evening peak hour, the project is expected to generate about 350 pedestrian trips. In the year 2000, the project is expected to generate approximately 760 pedestrian trips during the morning peak hour and about 920 pedestrian trips during the evening peak hour. Figures IV-A-31 through IV-A-38 illustrate the 1995 and 2000 morning and evening peak hour pedestrian volumes for both No-Build and Build conditions.

Commuter Peak Hour Pedestrian Impacts

This section addresses the commercial component impacts on the peak commuter pedestrian hours. Future pedestrian volumes, distribution, and level of service are presented below.

Future pedestrian volumes are developed by adding existing pedestrian volumes to background development and New Boston Garden Development volumes. Background pedestrian volumes are calculated by applying the same trip generation rates used for the project to other developments in the area that are expected to be completed by 1995 and 2000.



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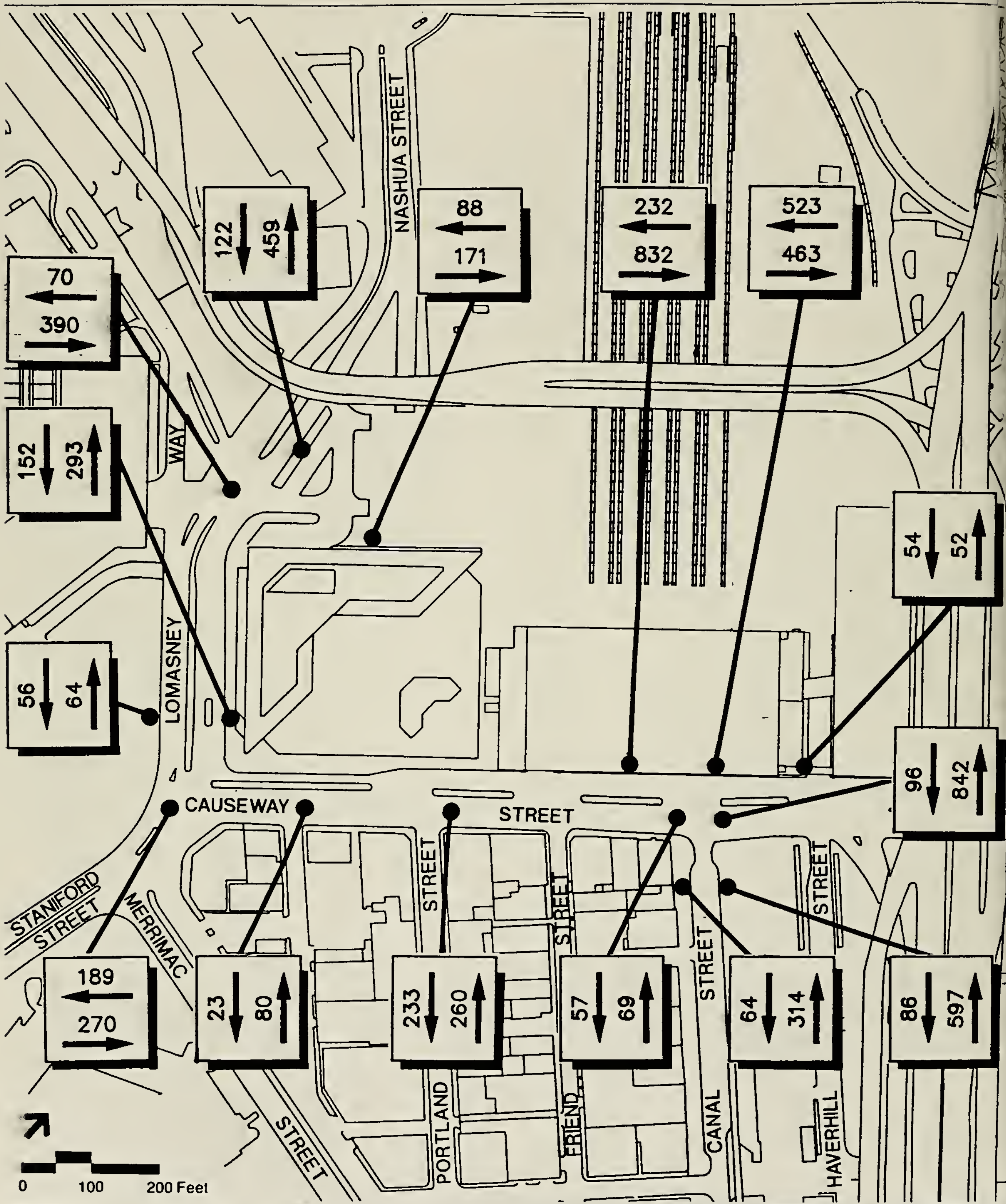
1995 No-Build Morning Commuter Peak Hour Pedestrian Volumes

Figure IV-A-31



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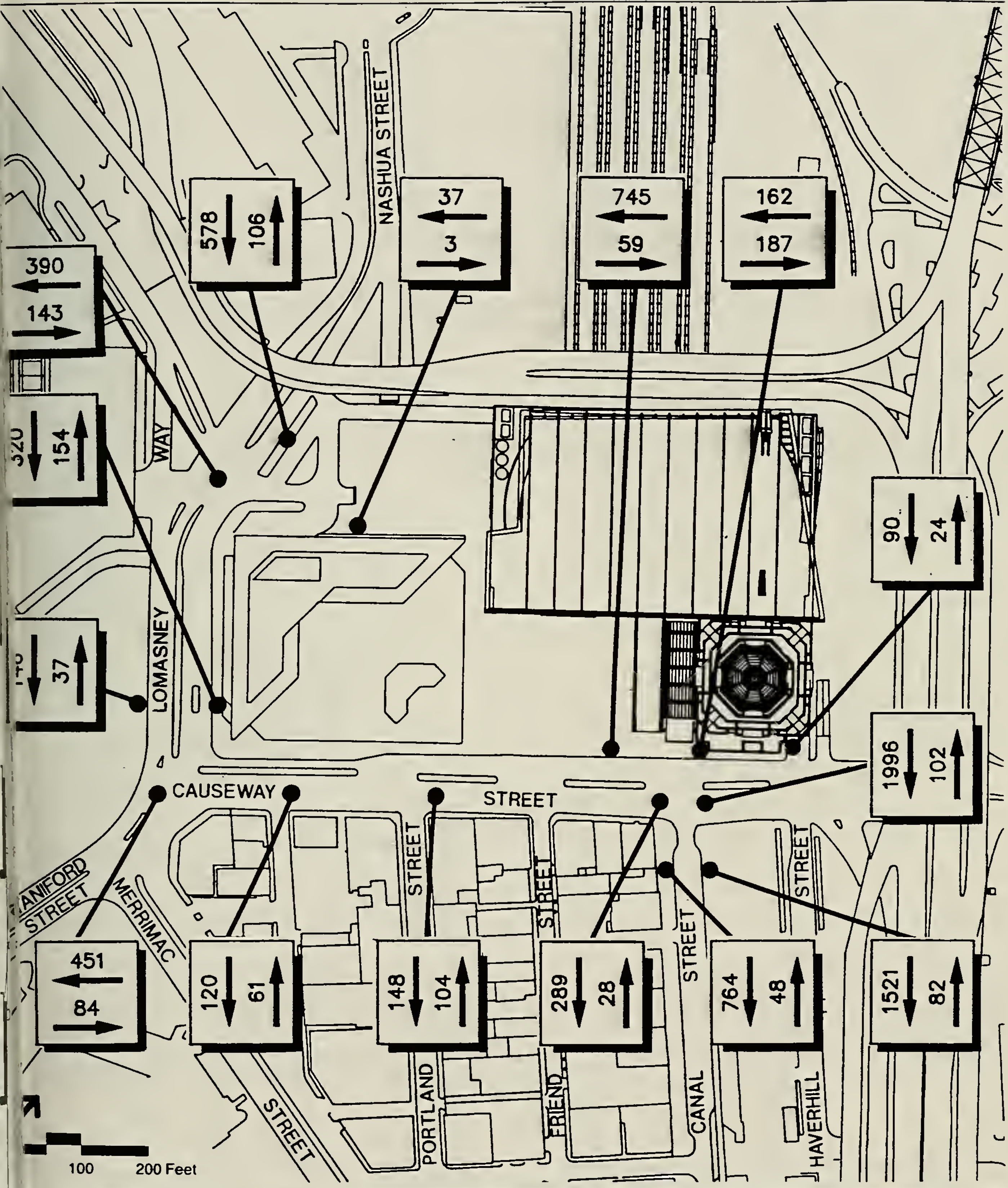
1995 No-Build Evening Commuter Peak Hour Pedestrian Volumes

Figure IV-A-32



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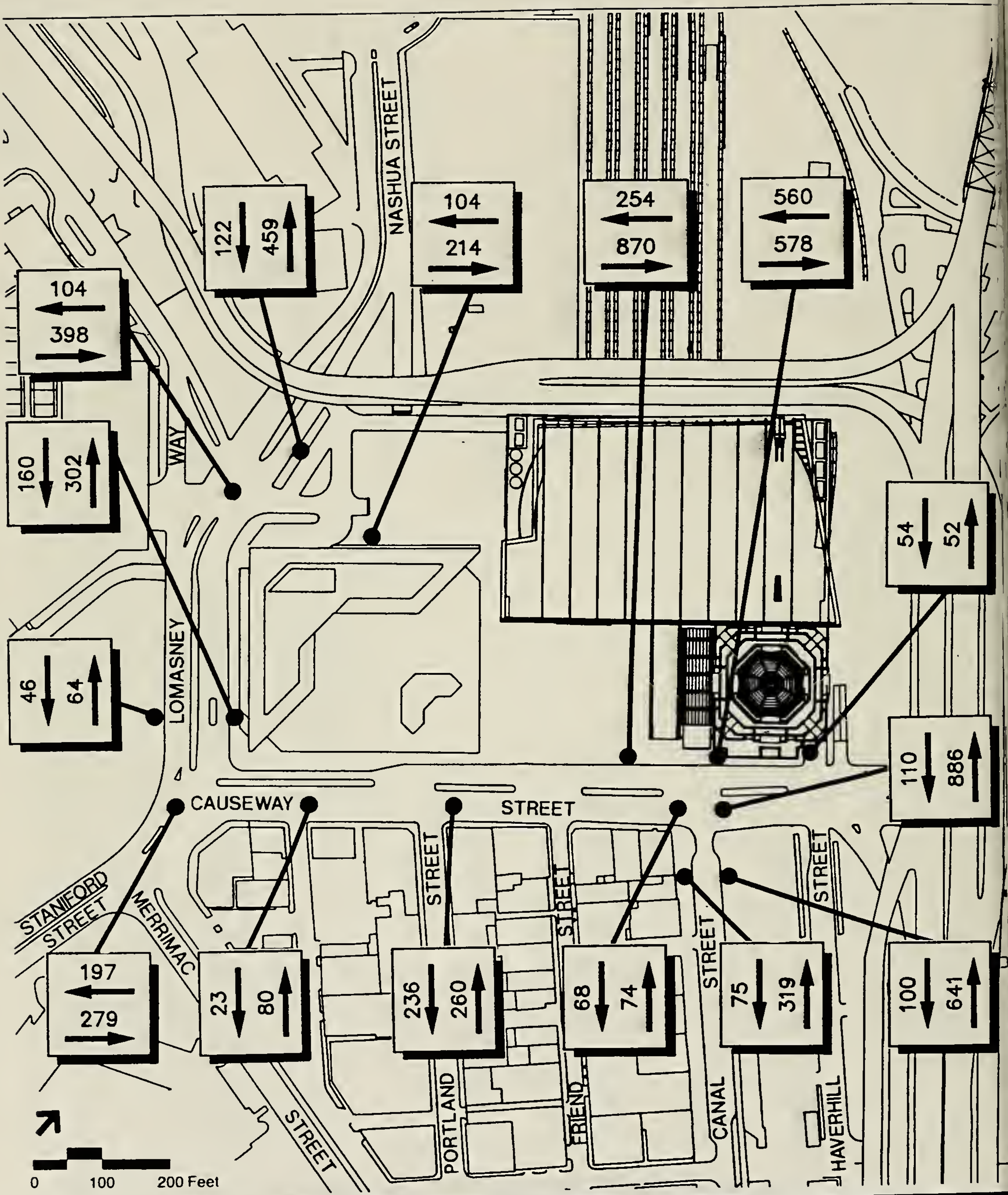
1995 Interim-Build Morning Comuter Peak Hour Pedestrian Volumes

Figure IV-A-33



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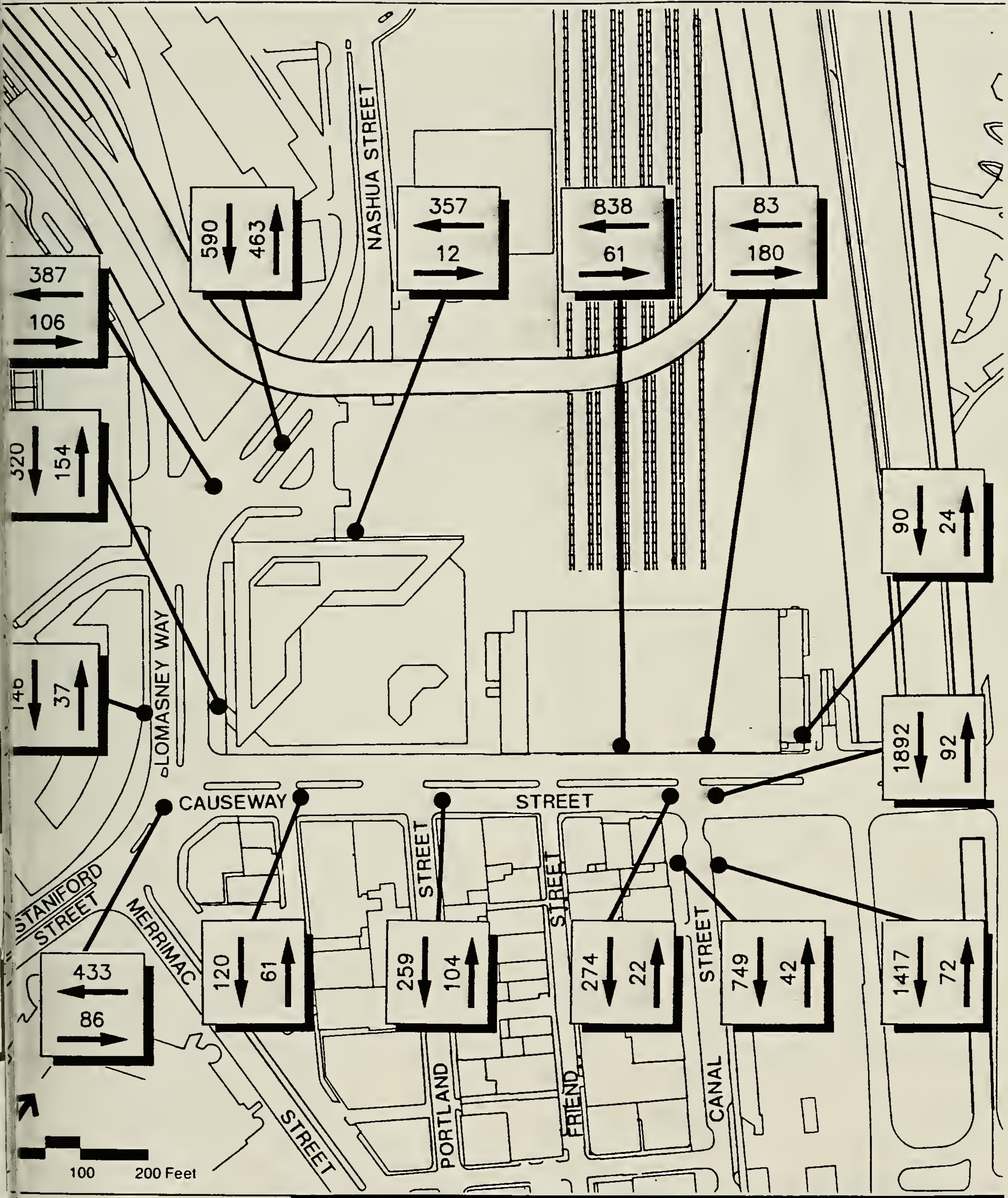
1995 Interim-Build Evening Comuter Peak Hour Pedestrian Volumes

Figure IV-A-34



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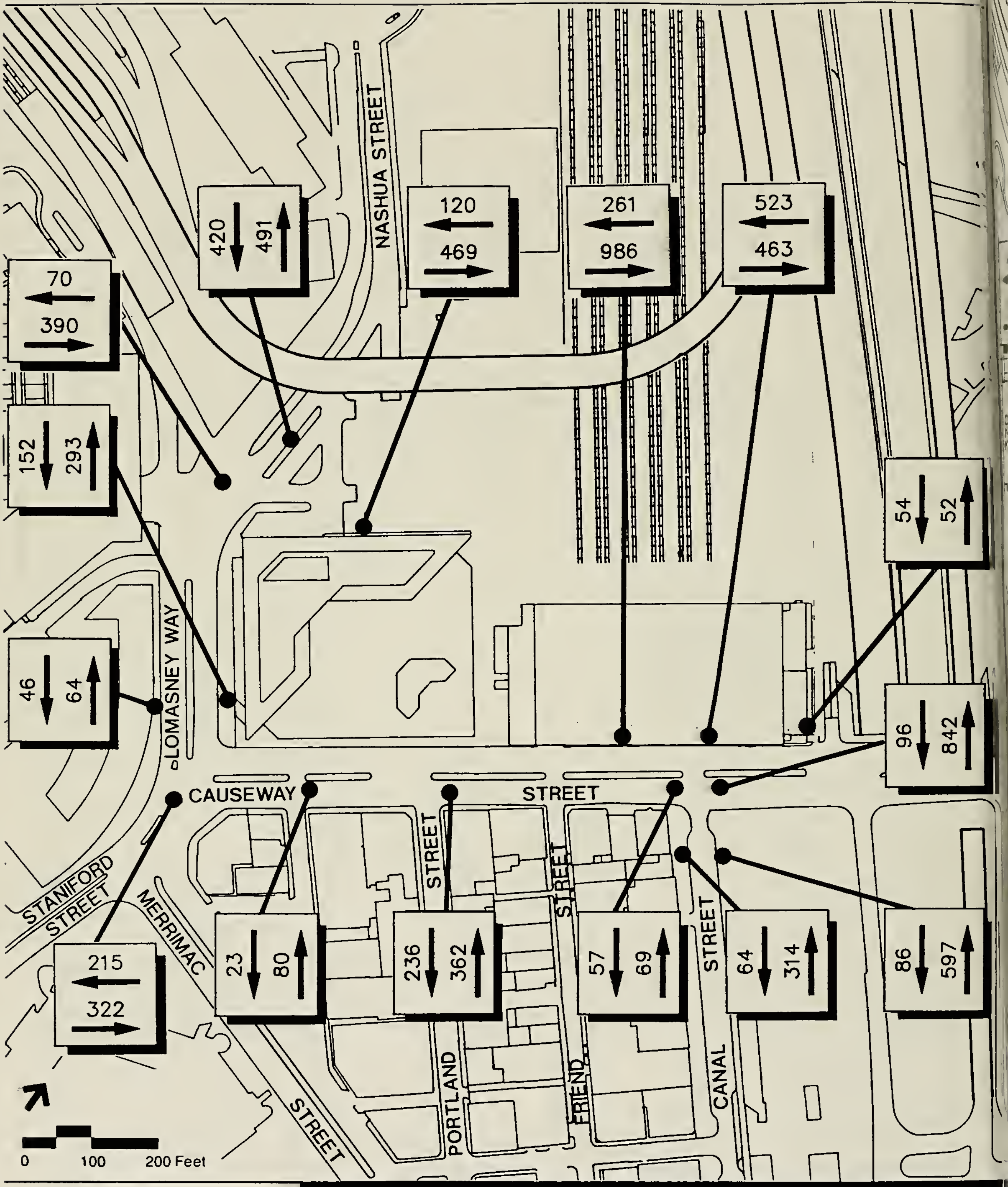
2000 No-Build Morning Comuter Peak Hour Pedestrian Volumes

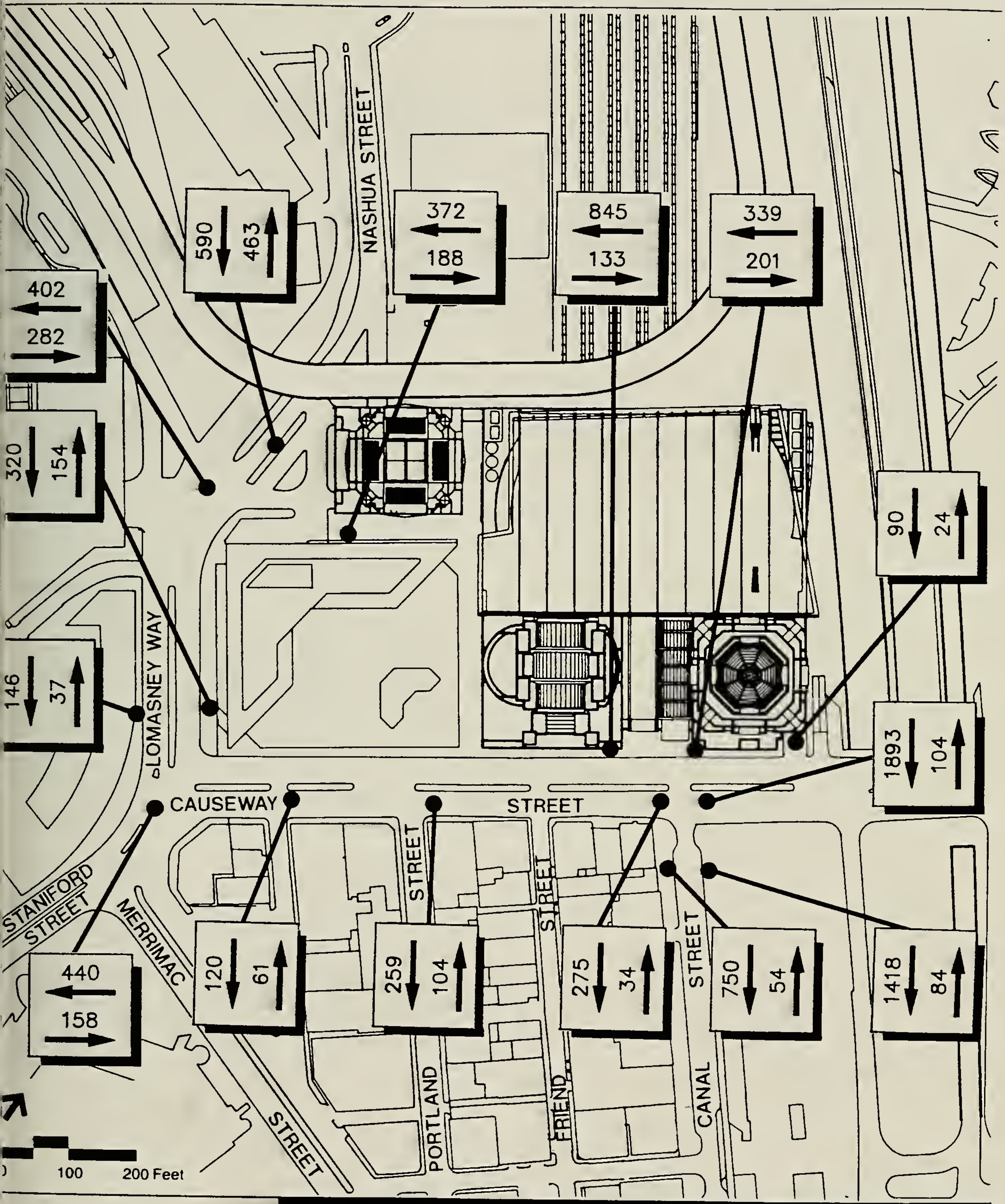
Figure IV-A-35



Vanasse Hangen Brustlin, Inc.

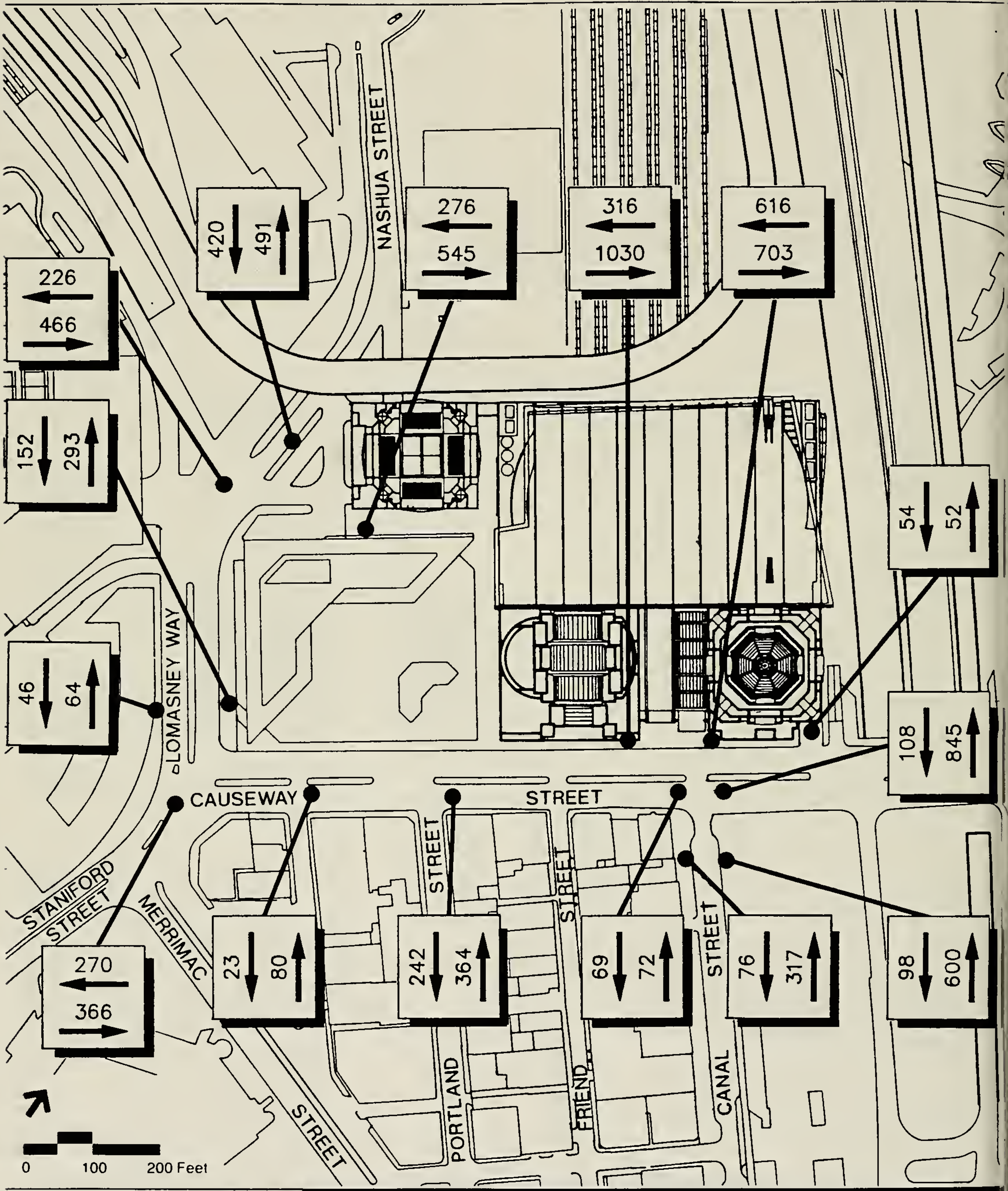
2000 No-Build Evening Commuter Peak Hour Pedestrian Volumes

Figure IV-A-36



2000 Full-Build Morning Commuter Peak Hour Pedestrian Volumes

Figure IV-A-37



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2000 Full-Build Evening Commuter Peak Hour Pedestrian Volumes

Figure IV-A-38

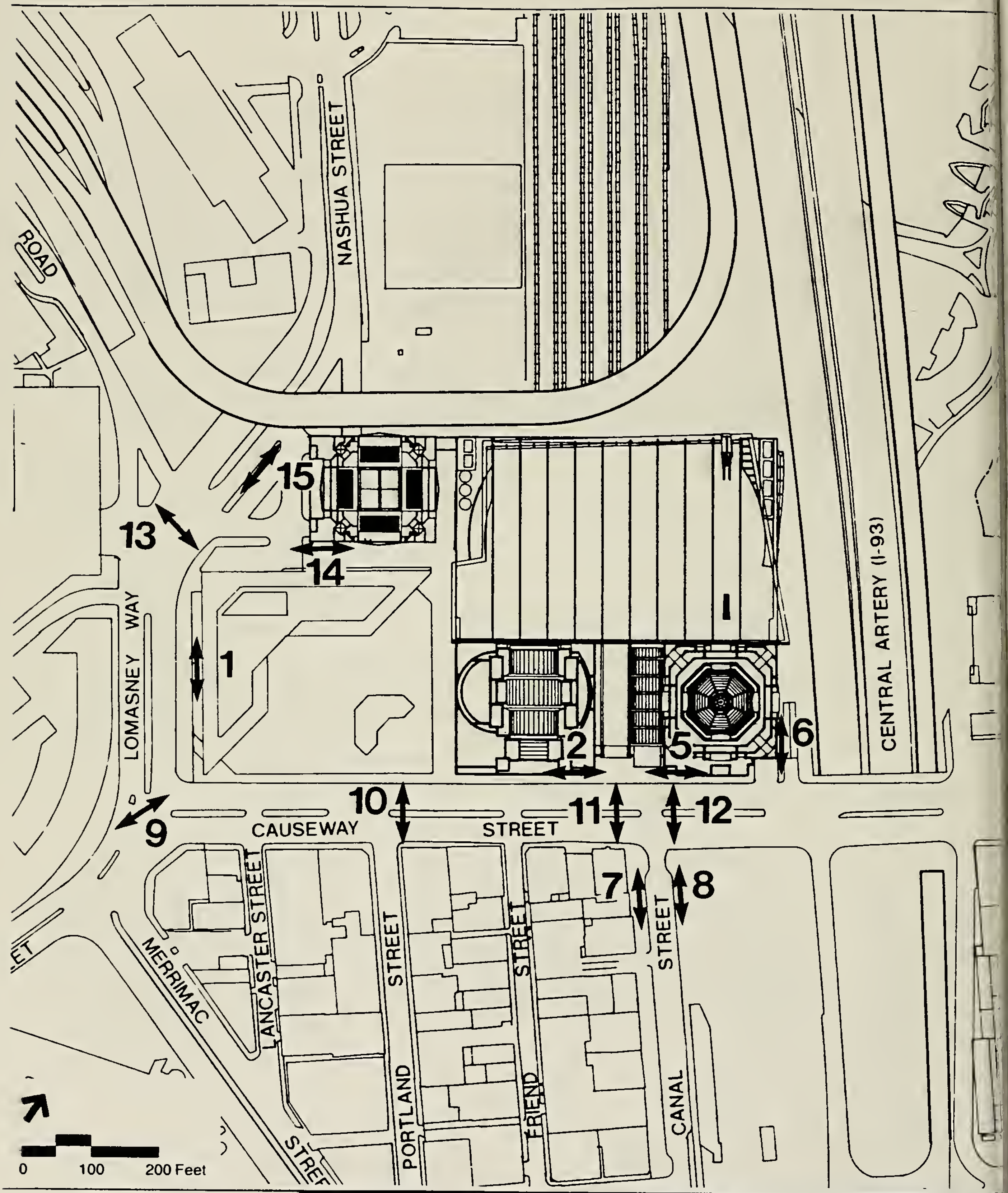
The pedestrian trips generated by the proposed project are assigned specific routes to and from the site. Assignment and distribution of future pedestrian trips is done individually for parking trips and walk trips. Due to the surplus of on-site parking in 1995, distribution and assignment for these resulting parking-related pedestrian trips is based on existing distribution patterns to and from North Station. Due to the deficit of on-site parking in 2000, distribution and assignment for these parking-related pedestrian trips is based on the location and capacity of public parking facilities in the area. For future walk trips, distribution and assignment are based on the location of nearby residential areas. All future pedestrian volumes are assigned to the pedestrian network with Nashua Street improvements in place.

Using procedures described in the Existing Conditions section of this chapter, level-of-service (LOS) analyses were conducted for the 1995 and 2000 design years during the morning and evening commuter peak hours. The analysis locations for all future conditions are shown in Figure IV-A-39.

Tables IV-A-57 through IV-A-60 show pedestrian peak hour level-of-service results for 1995 and 2000. Under average conditions, all locations continue to operate at LOS C or better for all analyzed periods. In some cases, such as along walkways on Causeway Street, level-of-service results are improved from existing conditions due to modifications to the walkway geometry which will provide more space for pedestrians. For surge conditions, all locations continue to operate at acceptable levels of service (D or better) under all conditions.

Although a significant number of pedestrian trips are expected to be generated by the project, on-site parking and rapid transit access/egress allow pedestrians to remain on-site rather than in adjacent walkways and crosswalks. Therefore, future pedestrian traffic generated by the New Boston Garden Development is not expected to adversely impact any analysis location. In the future, all locations are expected to remain at acceptable levels of service for both average and surge conditions.

It should be noted that although there is no traffic signal at Causeway Street and Canal Street, an analysis was conducted for Build conditions based on a traffic signal proposed under traffic mitigation. With a signal, acceptable pedestrian level of service will be provided under both 1995 Interim-Build and 2000 Full-Build conditions. In addition, two walkway locations that were analyzed under existing conditions no longer exist in the future (Locations 3 and 4) due to geometric changes and are, therefore, not analyzed under future conditions. Two new walkway locations are analyzed in future conditions.



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Future Pedestrian Analysis Locations Figure IV–A–39

Table IV-A-57 **1995 PEDESTRIAN WALKWAY LEVEL-OF-SERVICE**

Sidewalk	Location Designation*	Period	Average Condition Flow Rate**	Average Condition LOS***	Platoon Condition+ Flow Rate	Platoon Condition+ LOS
Lomasney east side (between Causeway Street and site driveway)	1	Morning No-Build	0.6	A	4.6	B
		Morning Build	0.6	A	4.6	B
		Evening No-Build	0.6	A	4.6	B
		Evening Build	0.6	A	4.6	B
Causeway Street north side (west of entrance)	2	Morning No-Build	1.7	A	5.7	B
		Morning Build	1.0	A	5.0	B
		Evening No-Build	2.1	B	6.1	B
		Evening Build	1.2	A	5.2	B
Causeway Street north side (east of entrance)	5	Morning No-Build	0.6	A	4.6	B
		Morning Build	0.4	A	4.4	B
		Evening No-Build	2.2	B	6.2	B
		Evening Build	1.3	A	5.3	B
Accolon Way	6	Morning No-Build	0.6	A	4.6	B
		Morning Build	0.6	A	4.6	B
		Evening No-Build	0.6	A	4.6	B
		Evening Build	0.6	A	4.6	B
Canal Street west side (south of Causeway Street)	7	Morning No-Build	2.9	B	6.9	B
		Morning Build	3.0	B	7.0	C
		Evening No-Build	1.6	A	5.6	B
		Evening Build	1.7	A	5.7	B
Canal Street east side (south of Causeway Street)	8	Morning No-Build	5.0	B	9.0	C
		Morning Build	5.4	B	9.4	C
		Evening No-Build	2.8	B	6.8	B
		Evening Build	3.0	B	7.0	B
Site Driveway (north of GSA Building	14	Morning No-Build	0.0	A	4.0	B
		Morning Build	0.1	A	4.1	B
		Evening No-Build	0.4	A	4.4	B
		Evening Build	0.4	A	4.4	B
Nashua Street east side (north of site driveway)	15	Morning No-Build	2.2	B	6.2	B
		Morning Build	2.2	B	6.2	B
		Evening No-Build	1.6	A	5.6	B
		Evening Build	1.6	A	5.6	B

* See Figure IV-A-xx.

** Pedestrians per minute per foot.

*** Level of service.

+ Average flow rate + 4.0.

Table IV-A-58 1995 PEDESTRIAN CROSSWALK LEVEL-OF-SERVICE

Crossing	Location Designation*	Period	Average Condition		Surge Condition	
			Space**	LOS***	Space	LOS
Lomasney Way at Causeway Street	9	Morning No-Build	121	B	66	B
		Morning Build	128	B	66	B
		Evening No-Build	164	A	77	B
		Evening Build	128	B	66	B
Causeway Street at Portland Street	10	Morning No-Build	629	A	150	A
		Morning Build	614	A	146	A
		Evening No-Build	315	A	75	B
		Evening Build	313	A	74	B
Causeway Street at Canal Street west	11	Morning Build+	514	A	120	B
		Evening Build+	1,647	A	268	A
Causeway Street at Canal Street east	12	Morning Build+	78	B	18	D
		Evening Build+	232	A	38	C
Nashua Street at Site Driveway	13	Morning No-Build	248	A	175	A
		Morning Build	218	A	158	A
		Evening No-Build	113	B	132	A
		Evening Build	55	B	116	B

* See Figure IV-A-xx.
** Square feet per pedestrian.
*** Level of service.
+ Mitigated conditions.

Table IV-A-59 2000 PEDESTRIAN WALKWAY LEVEL-OF-SERVICE

Crossing	Location Designation*	Period	Average Condition Space**	Average Condition LOS***	Platoon Condition+ Space	Platoon Condition+ LOS
Lomasney Way east side (between Causeway Street and site driveway)	1	Morning No-Build	0.6	A	4.6	B
		Morning Build	0.6	A	4.6	B
		Evening No-Build	0.6	A	4.6	B
		Evening Build	0.6	A	4.6	B
Causeway Street north side (west of entrance)	2	Morning No-Build	2.0	A	6.0	B
		Morning Build	1.1	A	5.1	B
		Evening No-Build	2.5	B	6.5	B
		Evening Build	1.4	A	5.4	B
Causeway Street north side (east of entrance)	5	Morning No-Build	0.6	A	4.6	B
		Morning Build	0.6	A	4.6	B
		Evening No-Build	2.2	B	6.2	B
		Evening Build	1.5	A	5.5	B
Accolon Way	6	Morning No-Build	0.6	A	4.6	B
		Morning Build	0.6	A	4.6	B
		Evening No-Build	0.6	A	4.6	B
		Evening Build	0.6	A	4.6	B
Canal Street west side (south of Causeway Street)	7	Morning No-Build	2.9	B	6.9	B
		Morning Build	3.0	B	6.9	B
		Evening No-Build	1.6	A	5.6	B
		Evening Build	1.7	A	5.7	B
Canal Street east side south of Causeway Street)	8	Morning No-Build	5.0	A	9.0	B
		Morning Build	5.0	A	9.0	B
		Evening No-Build	2.8	B	6.8	B
		Evening Build	2.9	B	6.9	B
Site Driveway (north of GSA Building	14	Morning No-Build	0.4	A	4.4	B
		Morning Build	0.6	A	4.6	B
		Evening No-Build	0.7	A	4.7	B
		Evening Build	1.0	A	5.0	B
Nashua Street east side (north of site driveway	15	Morning No-Build	3.1	B	7.1	C
		Morning Build	3.1	B	7.1	C
		Evening No-Build	2.4	B	6.4	B
		Evening Build	2.4	B	6.4	B

* See Figure IV-A-34.

** Pedestrians per minute per foot.

*** Level of service.

+ Average flow rate + 4.0 pedestrians per minute per foot.

Table IV-A-60 **2000 PEDESTRIAN CROSSWALK LEVEL-OF-SERVICE**

Crossing	Location Designation*	Period	Average Condition Space**	Average Condition LOS***	Surge Condition Space	Surge Condition LOS
Lomasney Way at Causeway Street	9	Morning No-Build	173	A	81	B
		Morning Build	147	A	69	B
		Evening No-Build	152	A	70	B
		Evening Build	133	A	60	B
Causeway Street at Portland Street	10	Morning No-Build	427	A	152	A
		Morning Build	427	A	152	A
		Evening No-Build	260	A	62	B
		Evening Build	256	A	61	B
Causeway Street at Canal Street west	11	Morning Build+	308	A	131	A
		Evening Build+	807	A	324	A
Causeway Street at Canal Street east	12	Morning Build+	42	B	20	D
		Evening Build+	120	B	48	B
Nashua Street at Site Driveway	13	Morning No-Build	292	A	194	A
		Morning Build	210	A	140	A
		Evening No-Build	155	A	141	A
		Evening Build	238	A	94	A

* See Figure IV-A-34.
** Square feet per pedestrian.
*** Level of service.
+ Mitigated conditions.

Loading

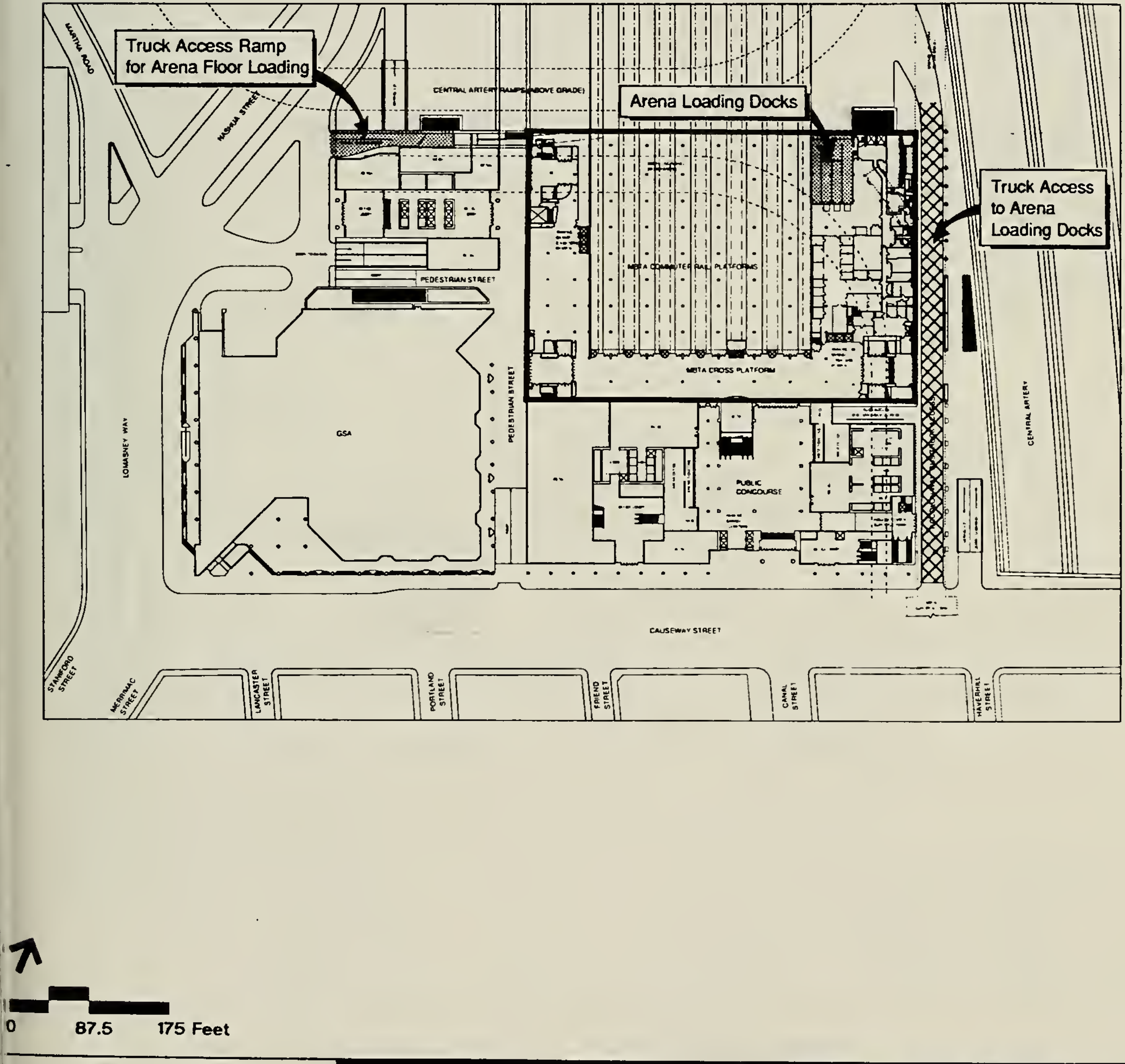
The proposed New Boston Garden Development ground floor and underground loading facilities are shown in Figure IV-A-40 and IV-A-41, respectively.

Arena Deliveries

For the arena, the loading docks are located at ground level in the rear (north side) of the site. The arena loading docks will accommodate up to four delivery vehicles at one time. These bays will be 65 feet long 11 feet wide. Access to these loading docks will be from Accolon Way.

A truck ramp for arena deliveries will be accessible from Nashua Street. This ramp will give trucks direct access to the arena floor to load and unload cargo. This will facilitate event changeover activities.

The site design also provides an off-street location for the large broadcast media equipment vehicles that currently park on Causeway Street during Boston Garden events. Chartered buses will be able to board and discharge passengers



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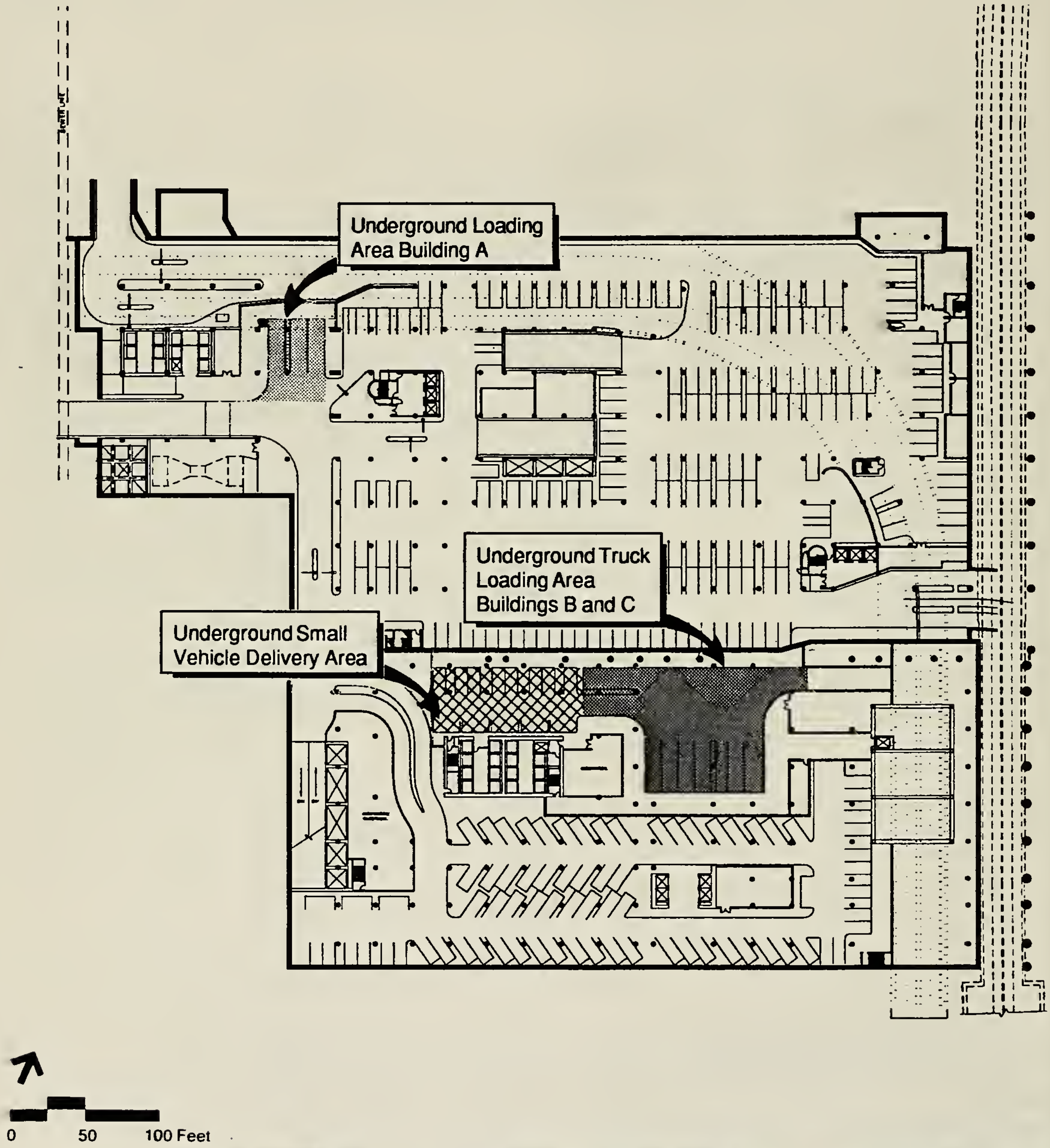
Future Loading–
Ground Floor

Figure IV–A–40


Underground Loading Area Building A
Underground Truck Loading Area Buildings B and C
Underground Small Vehicle Delivery Area
0
50
100 Feet

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Future Loading–Parking Level 1

Figure IV–A–41

off-street as well, something they cannot do today. Thus, in several ways, the New Boston Garden will provide improved traffic conditions on Causeway Street.

Commercial Deliveries

Although the new arena is not expected to generate a significant increase in loading activities, the commercial component will require new loading facilities. For this Draft EIR/PIR, an evaluation was conducted to assess the adequacy of the proposed loading facilities to accommodate expected demands associated with the commercial component.

The commercial component will be served by two off-street, underground loading facilities. The facility beneath Building A, accessed via the MBTA garage, will contain three 40-foot loading bays, designed to accommodate medium-sized trucks and smaller vehicles. A second facility, located beneath Buildings B and C and accessed via a dedicated ramp from Accolon Way, will contain six 50-foot loading bays, large enough for full-sized trucks. In addition, the second facility will have thirteen parking spaces for smaller delivery vehicles (such as vans and small trucks). Therefore, the two facilities together can handle six full-sized trucks, three medium size trucks, and thirteen vans or small trucks simultaneously--twenty-two vehicles in all.

Delivery vehicle-trip generation rates were developed from surveys conducted for the Prudential Center Redevelopment EIR. Based on these rates, approximately 275 daily deliveries are expected for the commercial component of the New Boston Garden Development. Of these, approximately 15 percent, or 42 deliveries, are expected to arrive during each of the two daily peak delivery hours (10:00 to 11:00 AM and 1:00 to 2:00 PM).

The adequacy of the loading facilities for the anticipated demand depends also on the length of time needed to complete the expected deliveries and the vehicle-size distribution of the expected deliveries. Deliveries to typical office buildings are predominantly letters and small packages delivered by van, taxicab, or bicycle. Since these deliveries are usually completed within five or ten minutes, the proposed facilities are expected to be more than adequate for them. (The thirteen small-vehicle spaces could handle seventy-eight deliveries per hour at an average duration of ten minutes.)

The adequacy of the nine truck bays (three beneath Building A and six below Buildings B and C) proposed for the commercial component of the Project will depend on the timing of deliveries, the size of vehicles used, and the duration of stay at the truck bays. Should logistical problems arise, building managers generally can influence these three critical factors by scheduling deliveries, implementing vehicle-size guidelines for vendors, and providing service personnel to distribute delivered materials within the complex.

Based on direct application of the formula in the Boston Zoning Code, the commercial component of the New Boston Garden Development requires thirteen loading bays. As noted above, the project design calls for nine truck bays and an additional thirteen parking spaces for delivery vans and small trucks. Considering the foregoing evaluation, it appears that the proposed combination of bays and spaces, with appropriate management, will handle the expected demand, thus satisfying the intent of the Zoning Code. The combination of fewer truck bays and more delivery van spaces may, in fact, be superior to the code requirements, due to the type of deliveries expected.

Conclusion

The New Boston Garden Development is designed to handle all loading activities on the project site. The commercial component will be served by two off-street underground loading facilities, containing a total of nine truck bays and thirteen parking spaces for small delivery vehicles. An evaluation was conducted of the adequacy of the loading facilities proposed for the commercial component. Based on this analysis, it appears that the proposed loading arrangements will be adequate for the expected demands of the commercial component.

The arena will have off-street facilities for deliveries, bus loading, and broadcast media equipment. This situation represents a significant improvement compared to the existing Boston Garden, which relies on Causeway Street for many of these activities.

Impacts of Construction

Project construction activities can affect the transportation system in two ways. First, construction can increase the demand on that system; construction workers must commute to and from the job site, and construction vehicles must haul material to and from the site. Second, it can decrease system capacity if a travel lane or a sidewalk needs to be closed to accommodate activities such as loading or unloading of construction vehicles.

The scope of this Draft EIR/PIR includes analysis of the impacts of project construction activities on the transportation system. This includes an assessment of daily construction vehicle volumes and an estimation of construction worker vehicle trips. It also includes an assessment of any loss of road capacity due to on-street construction staging. Measures to mitigate the transportation impacts of construction are included in the mitigation section.

Project construction is to occur in stages during a nine-year period beginning in 1991. The scheduling of the construction period serves to reduce daily truck volumes and construction worker trips. The construction schedule for the project will be carefully coordinated with construction schedules for the MBTA North Station project and the CA/T project.

Daily Construction Vehicle Volumes

Truck traffic will be generated by the need to remove excavated material and debris from the site and the need to deliver building materials such as steel and concrete. Generally, excavation generates the most truck traffic because of the volume of material to be hauled. Demolition usually generates the second-highest truck volumes, and cast-in-place concrete can also generate significant truck traffic. Therefore, these three activities were considered.

No excavation is required for the new arena, since it is being built on air rights above the MBTA garage. Excavation required for construction of the New Boston Garden Development is associated with the proposed 1,100-car garage beneath Buildings B and C and the Public Concourse. The excavation period, which is expected to be the peak period for construction vehicle traffic, will last approximately nine months (i.e., approximately 200 work days), beginning in the spring of 1994.

The volume of material to be excavated is estimated at 200,000 cubic yards (CY), which represents 1,000 CY per work day. Allowing for the fact that excavated material expands as it is transferred to trucks, one truck is required for every 10 CY excavated. Thus 100 daily truckloads, or approximately 12 truckloads per hour, of excavate will need to be hauled from the project site on an average workday during that nine-month period.

It is worth noting that, even without the New Boston Garden Development, some excavation of the garage site would be needed to accommodate the MBTA Green Line improvements at North Station. The excavation volume cited in the previous paragraph includes the portion needed for the Green Line.

Demolition of the existing arena will occur during a six-month period beginning in late 1993. The estimated quantity of demolition debris is 41,000 CY, or 330 CY per workday. Assuming 15 CY per truckload for demolition debris, approximately 22 truckloads per day will be needed for this task. Demolition will be complete before project Garage excavation begins.

Cast-in-place concrete also generates relatively high truck volumes, because each truck carries only a very small fraction of the quantity needed in a day. For example, concrete delivery for the new arena will take place during fifteen months beginning in June 1991. It will involve approximately 15,000 CY, or 40 CY per day. Assuming 5 CY per truck, this activity will involve approximately 8 truckloads per workday.

Truck volumes associated with other aspects of project construction are not yet known. However, the excavation period may be considered a peak period for construction vehicle activity. Average truck traffic generated during the remainder of the project construction period is likely to be less than one-quarter of the level generated by excavation.

Truck Routes

Specific truck routes will be mandated by the Boston Transportation Department (BTD) through a Construction Management Agreement, which is required for this project. Generally, the BTD selects routes to minimize impacts on local streets and make maximum use of available regional highways.

Trucks to and from the south and west are likely to be routed via the Central Artery's Causeway Street ramps. Trucks to and from the north will likely be routed either via Nashua Street or the Charlestown Bridge. Of course, several street and highway improvements are scheduled to be completed during the project construction period. Truck routes established at the beginning of the construction period can be modified to take advantage of these improvements as they come on line.

Construction Worker Vehicle Trips

Development of construction cost estimates for the proposed arena required a rough estimation of workforce size by construction phase. These estimates are as follows:

July 1991 through June 1992 - 100 workers
July 1992 through November 1992 - 375 workers
December 1992 through April 1993 - 525 workers
May 1993 through July 1993 - 100 workers

AVERAGE - July 1991 through July 1993 - 250 workers

Workforce estimates for the commercial component have not yet been developed. However, based on similar size construction projects in Boston, an average daily workforce of between 200 and 300 workers is expected.

Due to transit service availability and opportunities for ridesharing, it is projected that 30 cars for every 100 workers will be used for commuting to the site. These vehicle trips are not expected to have a significant impact on area traffic conditions, especially since they are likely to occur outside the areawide peak hours of 8:00 AM to 9:00 AM and 5:00 PM to 6:00 PM.

Construction Staging

Any use of public street or sidewalk space for construction staging requires a street occupancy permit from the Boston Transportation Department (BTD). The BTD generally requires developers to exhaust all on-site staging opportunities before a street occupancy permit is granted. The BTD also requires adequate provisions for safe pedestrian movement. This is particularly important in areas where high pedestrian volumes are present.

Construction of the proposed arena, which will be staged from the rear of the site, near Nashua Street, is not likely to require a street occupancy permit. On the other hand, construction of Buildings B and C will require some occupancy of Causeway Street. Recognizing the importance of maintaining traffic flow and pedestrian movement along Causeway Street, the proponent will work with the BTD to identify measures to mitigate impacts. Such mitigation measures are discussed in the mitigation section of this Draft EIR/PIR.

Conclusion

Project construction activities will require careful monitoring and mitigation to maintain traffic and pedestrian flows on Causeway Street. With appropriate mitigation measures, the impacts on the area's transportation system can be kept to a minimum.

TRANSPORTATION MITIGATION PLAN

Introduction

To minimize and reduce the potential impacts of the New Boston Garden Development, an extensive transportation mitigation plan has been developed covering the 1995 Interim-Build and 2000 Full-Build conditions. All the elements of Boston's Transportation Access Plan requirements have been addressed. The goal is to develop a thorough mitigation plan for this important project.

The many strategies described in this section reflect the fact that New Boston Garden Corporation clearly understands that the specific commitments outlined herein will be included in a legally binding Transportation Access Plan (TAP) agreement between the developer and the City of Boston.

Each strategy has been classified into one of the following categories:

- Travel demand management
- Public transportation
- Parking management
- Access and circulation design
- Loading
- Pedestrian improvements
- Roadway and traffic control improvements
- Construction traffic management
- General

Mitigation Summary

Because of the number of mitigation items, they have been summarized in Table IV-A-61 prior to more detailed descriptions following the table. Also, because the New Boston Garden Development consists of two distinct development proposals, i.e., an arena component and a commercial component, and because not all of the mitigation measures are applicable or appropriate for both, Table IV-A-61 associates each of the mitigation actions with one or both of the development components. An "A" after an item indicates that it is applicable to the arena component, a "C" to the commercial component, and a "B" to both components. The latter measures will be done independently by the proponents of the arena and the commercial component. They will be coordinated as appropriate.

Table IV-A-61 TRANSPORTATION MITIGATION SUMMARY

Travel Demand Management

- Establish a transportation coordinator position (B).
- Promote the concept of ridesharing through project marketing efforts (B).
- Cooperate with the city in implementing a computerized rideshare program such as RideSource (C).
- Work with the MBTA to establish a public awareness program on transportation options (B).
- Establish a preferential parking program for car and vanpools for the commercial component and work with the MBTA to do the same during arena events (B).
- Require project employers to assist in the implementation of the mitigation plan (C).
- Promote usage of public transportation services (B).
- Provide information to tenants about available public transit services (C).
- Implement a transit pass subsidy program for NBGC employees (A).
- Encourage transit pass subsidies by other employers (C).
- Sponsor a semi-annual "Transportation Awareness Day" (B).
- Promote bicycle transportation and provide secure bicycle parking (C).
- Encourage employers to implement alternative work schedules (C).
- Coordinate with other area employers to implement the Transportation Demand Management program (C).

Public Transportation

- Construct a project entrance to the new Green/Orange Line superplatform beneath Building C (C).
- Provide convenient pedestrian access to commuter rail from the project (B)
- Advertise MBTA services at arena events (A).
- Investigate the feasibility of special trains for arena events (A).
- Coordinate with the MBTA in the promotion of public transportation (B).

Parking Management

- Apply for a temporary parking freeze exemption to allow use of the parking garage as partial replacement for Central Artery/MBTA parking losses in 1995 (C).

(A) = arena component.
(B) = both components.
(C) = commercial component.

Table IV-A-61 TRANSPORTATION MITIGATION SUMMARY (Continued)

- Coordinate with the MBTA to integrate the project Garage with the adjacent MBTA garage and provide coordinated operation and maximum flexibility in the use of the available parking spaces (C).
- Reduce parking demand by limiting parking space commitments to tenants (C).
- Develop a parking pricing plan to encourage short-term parking or hold spaces off the market until 9:30 AM (C).
- Provide adequate parking for disabled persons (C).
- Use arena communication facilities to discourage neighborhood parking by arena patrons (A).

Access and Circulation Design

- Disperse vehicle activity by providing separate garage access/egress via Nashua Street and Accolon Way and by providing appropriate signage within the garage (C).
- Continue to work with the City of Boston (BTD), MBTA, and MDPW to develop appropriate designs for the Nashua Street-Lomasney Way Connector and for an improved Causeway Street (B).
- Separate arena bus/truck flows from garage traffic at the Accolon Way access/egress location (B).

Loading

- Work with appropriate agencies to provide off-street storage space for buses and for media-control vehicles during arena events (A)
- Disperse delivery vehicle activity by providing separated access/egress via Nashua Street and Accolon Way (B).
- Require all commercial deliveries be made to off-street underground docks (C).
- Discourage commercial deliveries during commuter peak periods (C).
- Minimize truck traffic during arena changeovers (A).
- Provide an operator management plan for arena deliveries (A).
- Provide sufficient off-street space to prevent on-street truck backing or queuing (C).
- Provide a separate truck ramp for the arena to avoid on-street truck staging (A).

Pedestrian Improvements

- Provide connections (internal to the project) to the MBTA's adjacent rapid transit and commuter rail stations (B).
- Provide a Public Concourse for pedestrian access to the arena, the commercial development, the transportation complex, and the garages (C).

(A) = arena component.
(B) = both components.
(C) = commercial component.

- Improve pedestrian connections to the GSA Building and the Charles River area, and across Nashua Street, Lomasney Way, and Causeway Street (B).
- Create a new pedestrian arcade along the Causeway Street sidewalk at Buildings B and C (C).
- Implement a project-wide pedestrian guide-sign program (B).
- Provide pedestrian lighting on-site (B).
- Provide full accessibility to disabled persons on-site (B).
- Provide public accessibility to the entire ground floor level within the site (B).
- Coordinate with the MBTA, GSA, MDC, and MGH in the provision of pedestrian facilities (B).

Roadway and Traffic Control Improvements

- Provide funding for concept planning of the Nashua Street-Lomasney Way Connector (see Access and Circulation Design) from Causeway Street to just north of the Central Artery ramps (B).
- Contribute to the concept planning and design of Causeway Street (see Access and Circulation Design) (B).
- Contribute to the design of the Nashua Street-Lomasney Way Connector (B).
- Contribute to the construction cost of the Nashua Street-Lomasney Way project (B).
- Provide coordination with the Boston Public Works Department and BTD for design work being done on the Merrimac Street and Lomasney Way improvement projects (B).
- Support the city's enforcement program of existing traffic and parking regulations in the project area by providing funding for traffic control officers for use during Boston Garden events (A).
- Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street (Lowell Square) - For 1995 no mitigation is required. For 2000, prohibit parking on the Staniford and Merrimac street approaches and widen Causeway Street to provide four approach lanes. Provide protected left-turn phases, and allow concurrent pedestrian flow during through traffic phases (B).
- Causeway Street and Canal Street - For 1995, signalize. For 2000, reconfigure to provide a center median and one additional lane each way during peak periods; parking can remain during off-peak hours (B).

(A) = arena component.
(B) = both components.
(C) = commercial component.

Table IV-A-61 **TRANSPORTATION MITIGATION SUMMARY (Continued)**

- Causeway Street and Accolon Way - For 1995, signalize and restrict parking on the Causeway Street westbound approach (all hours) and in the eastbound median and curb lanes (peak hours). For 2000, revise signal phasing and timing, reconfigure the intersection to include a center median and three lanes each way, with peak period parking restrictions (B).

- Causeway Street, North Washington Street, and Commercial Street (Keany Square) - For 1995, extend the afternoon parking ban on North Washington Street approach to the morning peak. For 2000, maintain peak hour parking restrictions and widen the Commercial Street approach to three lanes, while still preserving the two eastbound lanes on Commercial Street (B).

- Cambridge Street and Staniford Street - For 1995, no mitigation is required. For 2000, prohibit parking on the Staniford Street approach during both peaks to create dual right-turn lanes; adjust signal timing (B).

- Cambridge Street and New Chardon Street - Adjust signal timing in 1995 and 2000 (B).

Construction Traffic Management

- Define a construction traffic management plan (B).

- Designate truck routes (B).

- Provide covered pedestrian walkways (B).

- Provide adequate on-site storage areas for construction materials. (B).

- Encourage construction workers to use public transportation (B).

- Provide truck waiting areas (B).

- Provide police officer traffic management (B).

- Develop a construction graphics program (B).

- Coordinate with BTD in the creation and implementation of a construction traffic management plan (B).

Access Goals and Monitoring

- Implement a transportation monitoring program in response to the Boston Transportation Department's requirements (C).

(A) = arena component.
(B) = both components.
(C) = commercial component.

The following sections describe each mitigation measure. Those that relate to the arena will be implemented on completion of the new facility. They are designated by an "A" after the item heading. Those that relate to the commercial development (designated by a "C") will start to come on line with occupancy of the first building and be expanded to include later phases as they are built and occupied. Items relating to both components have a "B" designation. These will be done independently by the proponents of the arena and commercial component and coordinated as appropriate. The timing for the various street improvement measures will be worked out in cooperation with the implementing agencies.

Travel Demand Management Improvements

Reducing the amount of traffic generated by the New Boston Garden Development is a key component of the mitigation plan. New Boston Garden Corporation understands the community's concern over possible traffic impacts and has developed an extensive series of travel demand reduction strategies to reduce the impacts of the project. When integrated into a comprehensive transportation management plan that includes all types of strategies listed above, travel demand management can reduce automobile usage and, thereby, lessen the need for physical improvements to roadways and minimize the need for parking. The following measures are designed to reduce the number of vehicle trips to the project area during peak commuting hours and arena events, and on a daily basis.

Establish a Transportation Coordinator Position (B)

The proponent currently has a development/marketing department for the existing Boston Garden, so several of the activities identified in this section are already in operation. However, it is proposed that this arrangement be formalized by designating a staff person to be the Transportation Coordinator. This person will be responsible for addressing the development's transportation plan, including identifying and responding to transportation-related issues and concerns. The specific objective is to implement measures that minimize automobile use to and from the project as described in this mitigation section. Activities toward this objective include, but are not limited to, the following:

- Coordinate ridesharing (car and vanpooling) activities

- Promote transportation options through periodic newsletters, special events, publicity, and tenant relations

- Encourage tenants to implement alternative work schedules to spread peak-hour travel

- Work with the MBTA on all parking management issues relating to its garage adjacent to the project facility

- Participate in the establishment of access plan goals, monitor efforts, and submit annual reports to the city on compliance levels and mitigation effectiveness

- Provide up-to-date information on services, schedules, fares, etc. for project tenants and shoppers

- Act as the main contact person for all outside agencies and groups on transportation matters

Promote the Concept of Ridesharing Through Project Marketing Efforts (B)

Ridesharing, where commuters participate in carpools and vanpools, decreases the number of vehicles using area roadways and, thereby, reduces congestion, air pollution, and fuel consumption. The developer is strongly committed to promoting the concept of ridesharing. This will be done through a series of marketing efforts related to both the arena and the commercial component. Project employees as well as visitors and other users will be targeted in this campaign.

Implement a Computerized Rideshare Program (C)

The Commonwealth of Massachusetts, through the funding of a private, non-profit corporation (CARAVAN for Commuters, Inc.), has developed a computerized transportation ride-matching network called RideSource. RideSource matches commuters to carpools, vanpools, and public transportation options through an extensive database developed by CARAVAN. The proponent will install the program's software and develop the database with the assistance and support of CARAVAN. This computerized tool will greatly assist in the formation of carpools and vanpools by making data available to employees of the commercial component about the residence location and travel times of other commuters who might share a ride. To further encourage the use of vanpools, tenants will be informed about the advantages of vanpools and the opportunities to support them through CARAVAN and other similar programs.

Work with the MBTA to Establish a Public Awareness Program on Transportation Options (B)

The developer will disseminate promotional materials on all transportation modes for project employees through a comprehensive public awareness campaign. The program will be developed in cooperation with the MBTA. This program will be the responsibility of the Transportation Coordinator and will include a regularly published and distributed newsletter addressing ridesharing, public transit, and other opportunities to reduce vehicular travel demand.

Establish a Preferential Parking Program for Carpools and Vanpools (B)

The proponent will support carpools and vanpools by establishing a preferential parking program for these vehicles for the commercial component. The proponent also intends to provide a discount for vanpool parking spaces, creating an even greater incentive to use this mode of travel. Also, the proponent will work with the MBTA to establish a similar program in its garage during arena events.

Require Project Employers to Assist in the Implementation of the Mitigation Plan (C)

The proponent realizes that tenants will be the key participants in the transportation management process. Therefore, language will be incorporated into project leases which requires plan participation and cooperation with the Transportation Coordinator.

Promote Usage of Public Transportation Services (B)

An effective way to reduce the number of vehicles on the roadways serving the site is to strongly encourage employees to use public transportation as an alternate means of traveling to work. The project site is well served by public transportation with the MBTA Green Line, the Orange Line, Commuter Rail (Purple Line), AMTRAK service, and express bus service--all located within easy walking distance. The site's location provides an excellent opportunity for the project to generate an even higher proportion of public transportation users. The proponent is firmly committed to increased use of public transportation and will encourage and promote transit usage for arena employees and patrons as well as for the commercial component.

Provide Information to Tenants About Available Public Transit Services (C)

Continually upgraded information on traveling to the site from cities and towns in the region, as well as from Logan Airport, by public transportation will be provided to project tenants, shoppers, and visitors. The proponent will prepare a transportation brochure in cooperation with the Boston Transportation Department for public dissemination. The brochure will highlight public transportation, including information about station locations, fares, and schedules.

Implement a Transit Pass Subsidy Program for NBGC Employees (A)

As an example to project tenants, the proponent will voluntarily provide to its own employees a partial subsidy of the cost of public transportation passes for rapid transit, commuter rail, or commuter boat services.

Encourage Transit Pass Subsidies by Other Employers (C)

Another major element of the mitigation plan encourages tenants of the project to provide transit pass subsidies for their employees. The developer will attempt to obtain commitments from tenants regarding such subsidies. To do this, the proponent will prepare an exhibit for inclusion in all lease negotiations. The exhibit will encourage each tenant to adopt this type of subsidy program, as well as other demand reduction strategies.

Sponsor a Semi-Annual Transportation Awareness Day (B)

To promote the use of alternate means of travel to the site, the proponent will hold a semi-annual "Transportation Awareness Day". This event will include exhibits, special displays, promotional materials, and video presentations on alternative transportation services available to people traveling to the project. Information will also be provided on carpooling, vanpooling, and public transportation. NBGC will work with the MBTA, the BTD, and CARAVAN to plan the event. To stimulate interest in the Transportation Awareness Day, the developer intends to offer several raffle prizes for individuals who complete a short commute survey that will serve as input to the RideSource program.

Promote Bicycle Transportation and Provide Secure Bicycle Parking (C)

The developer recognizes the positive (though minimal) traffic reduction benefits from encouraging the use of bicycle transportation for traveling to the project. Therefore, the plan will establish areas that make cyclists comfortable leaving their bikes and, thereby, may encourage this mode of transportation. Providing bike lockers that can be rented through the parking garage operator is one possible option. These locations will be close to security staff or parking attendants to provide added security.

Encourage Employers to Implement Alternative Work Schedules (C)

Alternative work schedules offer a means of reducing peak hour travel demands on the roadway and transit systems by shifting travel to non-peak periods or by reducing the total number of trips made per week. The major schedule alternatives are:

- Staggered Work Hours. Generally set up in such a way as to assign groups of employees staggered starting times, typically at 15-minute intervals, spread over a one or two-hour period.

- Flexible Work Hours (Flextime). Allow employees to choose their own starting and finishing times, as long as they are present during the central part of the day (called core time).

- Compressed Work Week. Involves shifting some workers from a standard five days per week, eight hours per day schedule to fewer days of longer hours (e.g., four days per week, ten hours per day).

The developer will encourage all employers to establish alternative work hours programs. This will be done during the lease negotiation process.

Coordinate With Other Area Employers to Implement the Transportation Demand Management Program (C)

The comprehensive nature of the travel demand management program is likely to have a very beneficial affect on project travel demands and its resulting impacts on area transportation facilities. However, even more benefit can be gained if other area employers participate in similar activities. The proponent will coordinate with other employers in the North Station area to implement such measures.

Public Transportation

Measures will be implemented that enhance access to nearby public transportation facilities for project tenants, employees, and visitors. These enhancements are designed to increase the percentage of trips made via public transportation to the site by making use of these systems easier and more attractive.

Construct a Project Entrance to the New Green and Orange Line Superplatform Beneath Building C (C)

An important element of the overall mitigation plan for the project is to provide superior connections to area public transportation facilities. It has been the developer's goal to provide access to the MBTA's proposed new Green and Orange Line superplatform by physically integrating a station entrance into the project site. This access will be provided by means of a reciprocal easement agreement. This improvement benefits commuters, shoppers, and others by making it possible to enter the project site without being subjected to inclement weather. The entrance will be located within Building C.

Provide Convenient Pedestrian Access to Commuter Rail from the Project (B)

Another goal of the project is to improve pedestrian connections to the MBTA's proposed new North Station commuter rail facility. This is accomplished through a better design solution than the linkage which presently exists. A comfortable, climate controlled, and attractive interior pedestrian environment is created which provides improved connections to North Station. This pedestrian route will be clearly identified through signage, simplifying its use by pedestrians.

Advertise MBTA Services at Arena Events (A)

The New Boston Garden will provide a unique opportunity for public service messages to arena patrons at sports and other events through its electronic message board facilities. The proponent commits to developing appropriate messages to encourage use of MBTA services and to display those messages at arena events. Consideration will also be given to disseminating similar information to arena patrons when tickets are purchased by mail or at box office locations.

Investigate the Feasibility of Special Trains for Arena Events (A)

The MBTA currently has an arrangement with the Boston Red Sox and the New England Patriots to run special trains to those sports events. The proponent will work with the MBTA to investigate the feasibility of running a similar train to North Station in connection with sports or other events at the arena.

Coordinate With the MBTA in the Promotion of Public Transportation (B)

In addition to the above items, the proponent will coordinate with the MBTA to identify other public transportation initiatives that are likely to have a beneficial impact in reducing project area vehicle trips. These will be promoted in the arena and the commercial component.

Parking Management

A major feature of the project's mitigation program is the implementation of strategies to manage the parking facility in a manner that supports the other elements of the mitigation program. In particular, this involves implementing the many mitigation measures that discourage workers, shoppers, and visitors from driving alone. As stated earlier, some of these measures are establishing vanpool and carpool programs and discouraging all-day parking with pricing policies. The developer's intent is to provide adequate parking for those who must drive to the site, while at the same time providing incentives for those who can rideshare or use public transportation.

Apply for a Temporary Parking Freeze Exemption to Allow Use of the Parking Garage as Partial Replacement for Central Artery and MBTA Parking Losses in 1995 (C)

The proponent has initiated preparation of an application to the Boston Air Pollution Control Commission that would allow spaces in the project Garage to be exempt from the parking freeze during the initial years of Garage operation. This is to permit all spaces in the garage which are not required by project users during its early stages to be used by parkers who may be temporarily displaced by construction of the Central Artery and MBTA projects. The project Garage will be available to ease the supply situation during this critical period.

Coordinate With the MBTA to Integrate the Project Garage with the Adjacent MBTA Garage and Provide Coordinated Operation and Maximum Flexibility in the Use of the Available Parking Spaces (C)

The project Garage (1,100 spaces) will be located immediately adjacent to the MBTA's 1,300-space garage currently under construction. Even though space demands will be different for each facility, it will be advantageous to have both garages act as one and to have one operator in charge of all 2,400 spaces. This will permit maximum coordination during those times when it will be beneficial to operate as one large facility. Garage integration will provide maximum flexibility in the use of these spaces.

Reduce Parking Demand by Limiting Parking Space Commitments to Tenants (C)

The proponent has designed the project so as to limit parking commitments to tenants for monthly parking spaces in the garage by providing less than one-half space per 1,000 square feet of project. Although negotiating a lease with minimal parking can be a sensitive item, especially for long-term tenants, the developer recognizes it must take this action to reduce automobile trips by users of the proposed development.

Develop a Parking Pricing Plan to Encourage Short-Term Parking or Hold Spaces off the Market Until 9:30 AM (C)

No "early bird" discount will be provided. The proponent's goal is to price all-day parking in the garage at the upper boundary for this market area of the city to discourage all-day parking while trying to maintain short-term rates for visitors and shoppers at the lower end of the market. Alternatively, a number of spaces will be set aside for use only after the commuter peak period, e.g., 9:30 AM. The specific policy will be established in cooperation with the City of Boston.

Provide Adequate Parking for Disabled Persons (C)

The proponent will provide parking spaces for the disabled throughout the garage as the parking management plan is implemented. The project will be in full compliance with the Commonwealth's Architectural Access Board (AAB) standards.

Use Arena Communication Facilities to Discourage Neighborhood Parking by Arena Patrons (A)

Events at the Boston Garden sometimes generate parking demands which spill over into nearby residential neighborhoods, despite residential permit parking programs and other parking prohibitions in those areas. The arena proponent will take advantage of the arena's message board and public address systems in an attempt to discourage this type of behavior by arena patrons. Similar messages will also be printed in event programs.

Access and Circulation Design

New Boston Garden Corporation has initiated or participated in several measures aimed at providing an access and circulation system in the area of the project that will reduce not only project impacts but those of other major area proposals, including the Central Artery reconstruction and new MBTA garage.

Disperse Vehicle Activity by Providing Separate Garage Access/Egress by way of Nashua Street and Accolon Way and by Providing Appropriate Signage Within the Garage (C)

The proponent's early design studies for the project Garage have resulted in a dual entrance/exit configuration which will serve both the MBTA facility currently under construction and the adjacent project Garage when it comes on line. The in/out locations on the Nashua Street and Accolon Way sides of the project will not only disperse vehicle activity but will orient it to the reconstructed streets and highways proposed to be implemented in the next few years.

Continue to Work With the City of Boston (BTD), MBTA, and MDPW to Develop Appropriate Designs for the Nashua Street-Lomasney Way Connector and for an Improved Causeway Street (B)

NBGC was active during the early planning stages of the required new connector road between relocated Nashua Street and Lomasney Way. The proponent has worked closely with the City of Boston (BTD), MBTA, and MDPW to identify various design options not only for this area but also for Causeway Street between Lowell and Keany squares. NBGC will continue to work cooperatively in these efforts.

Continue to Coordinate with the City of Boston on the Design Details for the Merrimac Street Reconstruction Project (A)

As with other street design projects in the area, NBGC has worked with the City of Boston on the proposed reconstruction of Merrimac Street, attending meetings and offering input on appropriate design issues as they relate to the Lomasney Way-Nashua Street Connector project and possible future designs for Causeway Street. The proponent will continue that effort.

Separate Arena Bus and Truck Flows from Garage Traffic at the Accolon Way Access/Egress Location (B)

Different ramp systems will be provided for arena and commercial component traffic on the Accolon Way side of the project. All arena-related traffic, including commercial delivery trucks, buses, and media-control vehicles, will be physically separated from traffic to and from the garage below Buildings B and C. This separation will extend all the way out to Causeway Street and will promote increased safety and better traffic flow.

Loading

A sometimes overlooked part of a project's mitigation plan is in the area of loading, including the configuration of loading docks and service vehicle parking as well as the movement patterns for these vehicles. The measures below are designed to address these issues.

Work with Appropriate Agencies to Provide Off-Street Storage Space for Buses and for Media-Control Vehicles During Arena Events (B)

The proponent has proposed a design which incorporates plans for handling the large vehicles associated with arena events. These include buses and media vehicles, which currently must use segments of Causeway Street and which impede both vehicular and pedestrian travel during such events. Although the plan will significantly improve this condition, it requires use of land not entirely under the control of the proponent. Therefore, NBGC pledges to work with all appropriate city and state agencies to resolve this issue.

Disperse Delivery Vehicle Activity by Providing Separated Access/Egress by way of Nashua Street and Accolon Way (B)

Separate loading facilities and access points are provided at two project locations--Nashua Street and Accolon Way. This dispersal will reduce truck concentrations and allow easier access to and from the regional highway system.

Require All Commercial Deliveries to be Made to Off-Street Underground Docks (C)

The city's current policy is to require off-street loading, and it is the proponent's intention to comply with this policy. The actual need is estimated at approximately nine bays for the commercial development. Therefore, three bays are provided for Building A and six bays for Buildings B and C. In addition, 13 spaces will be provided for service vehicle parking. The arena will have four of its own receiving bays to the rear of the arena at grade level.

Discourage Commercial Deliveries During Commuter Peak Periods (C)

The developer is committed to working with the Boston Transportation Department to manage and control truck deliveries. The goal is to encourage midday, off-peak hour usage whenever possible for the commercial component.

Minimize Truck Traffic During Arena Changeovers (A)

Depending on the event, vehicle activity associated with event set-up and break-down can be considerable. However, virtually all of this activity is scheduled for off-peak times and the proponent is committed to this policy, even with the expanded schedule of events that is projected for the New Boston Garden.

Provide an Operator Management Plan for Arena Deliveries (A)

In association with the above, the proponent will require that a detailed management plan is in place for all arena events. This will cover elements such as truck staging, routing, timing, and layover regulations. The arena operator will be required to keep records to validate plan compliance.

Provide Sufficient Off-Street Space to Prevent On-Street Truck Backing or Queuing (C)

All loading and service vehicle parking areas for the commercial component are provided off-street in the underground garages below the site. Their location insures that there will be no impact on the local street system in terms of truck backing or queuing.

Provide a Separate Truck Ramp for the Arena to Avoid On-Street Truck Staging (A)

The arena will have its own truck ramp. It will be located between Nashua Street and the arena floor to accommodate all truck activity. There will be no truck staging on-street.

Pedestrian Improvements

Some of the most important benefits associated with the project will be in the area of pedestrian improvements. The site will be the focal point of the area in terms of pedestrian usage, and the mitigation plan strives to carry this emphasis throughout its structure.

Provide Connections (Internal to the Project) to the MBTA's Adjacent Rapid Transit and Commuter Rail Stations (B)

As mentioned previously, a major goal of the developer is to encourage use of the many public transportation resources in the area. This can be accomplished in part by simplifying access to these transit facilities through the creation of cleaner, safer, and more direct connections. When complete, pedestrians will have an easier, more direct route to public transportation with appropriate directional signage.

Provide a Public Concourse for Pedestrian Access to the Arena, the Commercial Development, the Transportation Complex, and the Garages (C)

The Public Concourse between Buildings B and C will align with Canal Street and define much of the pedestrian environment within the site. As such, it will provide access to all of the site's uses, including the New Boston Garden, the commercial buildings, all elements of the transportation complex, and the garages below.

Improve Pedestrian Connections to the GSA Building and the Charles River Area, and Across Nashua Street, Lomasney Way, and Causeway Street (B)

In addition to internal site travel patterns, the project will provide much improved access to and between adjacent locations such as the GSA Building and the Charles River area, as well as the surrounding street system. Pedestrians will be able to enjoy better orientation to each of these areas through the available connections.

Create a New Pedestrian Arcade Along the Causeway Street Sidewalk at Buildings B and C (C)

One feature that aids pedestrian movement around the existing North Station/Boston Garden environment is the pedestrian arcade along Causeway Street. This feature will be maintained with the creation of a new arcade as part of the design of Buildings B and C. Pedestrians will have access to the open air while being protected from inclement weather. The design will also provide a setback building line resulting in a substantially widened sidewalk along Causeway Street.

Implement a Project-Wide Pedestrian Guide-Sign Program (B)

A key element that ties many of the mitigation plan's physical components together is a project-wide pedestrian guide-sign program. Signage is used for many reasons: to direct pedestrians to and from public transportation services; to guide pedestrians to major attractions on the site (such as the New Boston Garden); to improve accessibility to the project and MBTA garages; and to guide shoppers to the project's retail establishments. The developer is committed to this component of the mitigation plan since proper signage is an important element in ensuring the project's success.

Provide Pedestrian Lighting On-Site (B)

The project is designed to include dramatic lighting in the public and pedestrian areas. Pedestrian scale lighting is located along all streets and accent lighting is located in all plazas, courtyards, and exterior project walkways for security and permitted evening use. Mounted lighting is located at all project and building entrances.

Provide Full On-Site Accessibility to Disabled Persons (B)

The design plans for the project also include major improvements to on-site circulation. Throughout the site, there is a strong desire to develop a circulation pattern that is relatively barrier free, allowing free movement by individuals with physical disabilities. Elevators and ramps are provided for barrier-free access throughout all interior and exterior spaces.

Provide Public Accessibility to the Entire Ground Floor Level Within the Site (B)

Despite the large footprint for the project, the design allows for unrestricted public access to all areas within the site. Retail spaces, walkways, arcades, concourses, and other pedestrian facilities create an environment suitable for strolling, shopping, lingering, or commuting, as the case may be, throughout the extent of the project's ground plane.

Coordinate With the MBTA, GSA, MDC, and MGH in the Provision of Pedestrian Facilities (B)

To obtain maximum benefit in the formulation of a pedestrian access plan for the project, the proponent will coordinate with other agencies and groups to obtain their thoughts and ideas, particularly since the access plan will affect abuttors to the project. These groups will include the MBTA, GSA, MDC, and MGH.

Roadway and Traffic Control Improvements

This section discusses potential mitigation measures that could be implemented to improve traffic operations at several intersections and along key corridors within the study area. Mitigation measures have been investigated for those locations expected to operate at deficient levels of service in the future and/or where the project is expected to cause significant impacts. The effect of specific operations improvements on intersection level of service is also described in this section.

Provide Funding for Concept Planning of the Nashua Street-Lomasney Way Connector (see Access and Circulation Design) from Causeway Street to Just North of the Central Artery Ramps (B)

The proponent has, since 1988, been making available the services of its transportation consultant to the City of Boston and others associated with this area for the purpose of identifying appropriate design concepts for the new connector road between relocated Nashua Street and Lomasney Way. Significant funds have been expended to identify, develop, and analyze various alternatives. This effort has led to interim and long-term design concepts for the connector. The interim plan is assumed to be in place for the 1995 analysis condition and the long-term plan for the 2000 analysis condition.

Contribute to the Concept Planning and Design of Causeway Street (See Access and Circulation Design) (B)

As noted below, several intersections along Causeway Street will require improvements by 2000, including widening to obtain additional travel lanes during commuter peak periods. It is tentatively proposed that this concept be applied throughout the entire length of Causeway Street between Lowell Square and Keany Square. Provision was made during construction of the GSA Building near Lowell Square for a widened Causeway Street. Holding the curb line on the south side of the street will allow three travel lanes each way plus a center median island for the entire segment except for a narrow portion east of Medford Street. The median will allow for left-turn lanes at key intersections (Lowell Square, Canal Street, and Accolon Way and New Frontage Road southbound). The existing signal at Portland Street can be removed since the reconstructed two-way Merrimac Street (scheduled for 1991 completion by the city) will carry the majority of north-south through traffic now carried by Portland Street. The curb lanes on both sides of widened Causeway Street can be used for parking or drop-off/pick-up during non-peak hours. East of Medford Street, which would remain unsignalized so as not to encourage easier left turns from traffic diverted off North Washington Street, two westbound and three eastbound lanes can be provided without widening beyond existing curb lines or reconfiguring the existing island. Appropriate pedestrian facilities and streetscape amenities can be provided as part of this plan that will enhance the street for its new use as the "front door" for the GSA Building, North Station, Boston Garden, and various other commercial properties with Causeway Street addresses. The proponent is prepared to contribute to the concept planning and design phases of this road improvement project.

Contribute to the Design of the Nashua Street-Lomasney Way Connector (B)

As a follow-up to the concept design phase discussed above, the proponent will contribute toward funding the engineering design of the connector road project. This includes development of final plans, specifications, and cost estimates for contractor bidding for both the interim and long-term connector plans.

Contribute to the Construction Cost of the Nashua Street-Lomasney Way Project (B)

The proponent will contribute toward the construction cost of the interim and long-term connectors. A fair-share cost allocation will be worked out between the proponent and other appropriate contributors, including the City of Boston, the MBTA, and the MDPW.

Provide Coordination With the Boston Public Works Department and BTD for Design Work Being Done on the Merrimac Street and Lomasney Way Improvement Projects (B)

The City of Boston is currently designing improvements for Merrimac Street and the MBTA is doing the same for Lomasney Way in connection with its new garage project at North Station. The proponent has designated its transportation consultant to provide coordination services in connection with these design efforts.

Support the City's Enforcement Program of Existing Traffic and Parking Regulations in the Project Area by Providing Funding for Traffic Control Officers for Use During Boston Garden Events (A)

Boston Garden events will continue to require special traffic control because of their sharp surges of pedestrian and vehicular activity before and after each event. These surges cannot be adequately controlled by means of traffic signals or signs. Manual control of the type provided by City of Boston traffic control officers is required. The proponent has, in the past, routinely hired special details at appropriate locations for Boston Garden events and commits to continue that policy for the new arena.

Additional Improvements at Specific Locations (B)

Summarized below are various traffic operations improvements proposed at several locations in the study area where significant project impacts are expected. The expected improvement in v/c ratio, delay, or level of service for each location is shown in Tables IV-A-62 and IV-A-63, which present these factors for unmitigated Build and No-Build, plus the mitigated Build condition for 1995 and 2000 during the morning and evening commuter peak hours, respectively. The proponent will contribute toward the design and construction of these measures in a fair-share cost allocation process to be worked out with the City of Boston, MBTA, MDPW, and others benefitting from these improvements.

Table IV-A-62 MORNING PEAK HOUR INTERSECTION LEVEL OF SERVICE WITH MITIGATION

				1995						2000					
	Existing			No-Build			Mitigated Build			No-Build			Mitigated Build		
Intersection Number and Location	V/C*	Delay**	LOS***	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
4 Causeway St./ Lomasney Way/ Staniford St./ Merrimac St.	0.70	30	D	0.61	20	C	NA	NA	NA	1.92	120+^	F	1.04	50	E
5 Causeway St./ Canal St.	---	---	(D)	---	---	(D)	0.73	16	C	---	---	(E)	0.92	20	C
6 Causeway St./ Accolon Way/ Haverhill St.	---	---	(D)	---	---	(D)	0.52	7	B	---	---	(E)	0.65	11	B
7 Causeway St./ N. Washington St./ Commercial St.	1.01	49	E	1.00	43	E	1.03	42	E	1.10	97	F	0.95	40	D
9 Cambridge St./ Staniford St./ Temple St.	0.68	24	C	0.64	19	C	NA	NA	NA	0.94	120+^	F	0.69	23	C
10 Cambridge St./ New Chardon St./ Bowdoin St.	0.80	37	D	0.83	42	E	0.83	34	D	0.76	68	F	0.76	26	D

* Volume-to-capacity ratio.

** Average stopped delay per vehicle in seconds.

*** Level of service.

^ Delay exceeds 120 seconds and cannot be computed accurately by CINCH.

( ) Unsignalized intersection analysis results.

Table IV-A-63 EVENING PEAK HOUR INTERSECTION LEVEL OF SERVICE WITH MITIGATION

				1995						2000					
							Mitigated Build						Mitigated Build		
Intersection Number and Location	Existing			No-Build						No-Build					
	V/C*	Delay**	LOS***	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
4 Causeway St./ Lomasney Way/ Staniford St./ Merrimac St.	0.66	26	D	1.03	51	E	NA	NA	NA	0.86	38	D	0.67	24	C
5 Causeway St./ Canal St.	---	---	(F)	--	---	(F)	0.95	32	D	--	---	(F)	0.91	33	D
6 Causeway St./ Accolon Way/ Haverhill St.	---	---	(E)	--	---	(F)	0.98	34	D	--	---	(F)	0.94	60	E
7 Causeway St./ N. Washington St./ Commercial St.	1.01	45	E	0.98	43	E	NA	NA	NA	1.09	89	F	1.00	58	E
9 Cambridge St./ Staniford St./ Temple St.	0.76	18	C	0.61	17	C	NA	NA	NA	1.28	60+	F	0.80	17	C
10 Cambridge St./ New Chardon St./ Bowdoin St.	0.84	47	E	0.87	55	E	0.86	38	D	0.97	58	E	0.93	31	D

* Volume-to-capacity ratio.
** Average stopped delay per vehicle in seconds.
*** Level of service.
^ Delay exceeds 120 seconds and cannot be computed accurately by CINCH.
( ) Unsignalized intersection analysis results.

Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street (Lowell Square). Little impact is expected in 1995; therefore, no mitigation is required. In 2000, a greater impact will result. During the morning peak hour, the v/c ratio will increase from 1.92 (No-Build) to 2.43 (Full-Build), both at LOS F. During the afternoon peak, v/c and level of service remain unchanged at 0.86 and D. The proposed mitigation includes prohibiting parking on the Staniford Street and Merrimac Street approaches (after reconstructing Merrimac Street as proposed by the City of Boston), and providing four approach lanes on Causeway Street, including separate left- and right-turn lanes. This configuration can be achieved by widening Causeway Street on the north side to the curb location already provided for when the GSA Building was constructed. These improvements will result in a v/c ratio of 1.04 and LOS E in the morning and a 0.67 v/c and LOS C in the afternoon.

Causeway Street and Canal Street. Without signalization, this location will operate at LOS F during the evening peak hour in 1995 and 2000 because of the difficulty of making left turns out of Canal Street. Therefore, the proposed solution for 1995 is to signalize the intersection. Parking can remain on Causeway Street since only two travel lanes each way are required. This will improve evening peak level of service to D. In 2000, the intersection will require one additional travel lane in each direction. The curb line adjacent to the New Boston Garden Development will allow for three lanes each way plus a median. During off-peak periods, the curb lane on each side can accommodate parking or drop-off/pick-up activity. Implementation of this plan will improve morning operation from LOS E to LOS C and afternoon operation from LOS F to LOS D.

Causeway Street and Accolon Way. Similar LOS F turning problems will result during the evening peak hour at this unsignalized location in the future. In 1995, signalization is proposed along with restriction of parking on the westbound Causeway Street approach. In the eastbound direction, no parking should be permitted along either the existing median or the curb lanes during the peak periods. In 2000, signal timing and phasing should be revised to accommodate the newly constructed Surface Artery Southbound, and Causeway Street should be configured as described for the Canal Street intersection. Peak period parking restrictions should be enforced along Causeway Street. Peak period level of service will then be B in the morning and E in the afternoon, instead of LOS F.

Causeway Street, North Washington Street, and Commercial Street (Keany Square). This location is not expected to be significantly impacted in 1995. In 2000, the project will increase morning and afternoon v/c ratios only slightly, although average delay will increase by 10 to 11 seconds. Proposed improvements include extending (by 1995) the current afternoon parking ban on the North Washington Street approach to the morning, and widening the Commercial Street approach (by 2000) to provide an additional lane (resulting in two through lanes and a right-turn lane). The two existing eastbound lanes on Commercial Street should be preserved. These measures will improve morning level of service from F to D and evening level of service from F to E, with significantly reduced delays during both periods.

Cambridge Street and Staniford Street. This location will not experience much project impact in 1995. In 2000, the morning peak v/c ratio is estimated to increase from 0.94 to 1.13 and the afternoon ratio from 1.28 to 1.35 (LOS F in both cases with or without the project). To improve operation in 2000, it is proposed that parking be prohibited on the Staniford Street approach during both peak periods to provide dual right-turn lanes. Signal timing should also be adjusted. These measures will reduce v/c ratios to 0.69 in the morning (LOS C) and 0.80 in the afternoon (LOS C).

Cambridge Street, New Chardon Street, and Bowdoin Street. No project impact is expected at this intersection. However, signal timing changes would be appropriate in 1995 and 2000 for both peak periods. By reallocating 2 to 5 seconds per signal cycle from the Cambridge Street green phase to the New Chardon Street and Bowdoin Street green phase, acceptable intersection levels of service can be achieved in both peak hours under all future conditions analyzed. Since these small adjustments are compatible with those recommended for the nearby intersection of Cambridge Street and Staniford Street, signal progression along Cambridge Street would be maintained.

It should be noted that no improvements have been proposed at either Leverett Circle or at City Square, despite LOS E or F conditions. At Leverett Circle, current poor conditions will be improved to LOS B or C upon completion of the Central Artery reconstruction project due to substantial improvements at the circle. Until that time, there is little additional improvement that can be implemented. At City Square, the state has selected a design configuration. The New Boston Garden Development is not expected to add significant amounts of traffic through City Square under either 1995 or 2000 analysis conditions.

Construction Traffic Management

An important component of the Transportation Access Plan is the creation of effective measures designed to safely accommodate vehicular and pedestrian traffic flow during the project's construction. Summarized below are several measures that the developer and the construction contractors will incorporate into the construction traffic management plan and the construction mitigation agreement for the project. The developer will also assign a staff person to ensure the identified commitments are enforced.

Define a Construction Traffic Management Plan (B)

A master construction traffic management plan will be developed with the city. It will detail the specific commitments to be followed by the developer and the construction contractors throughout all phases of the project and will be considered as a legally binding document.

Designate Truck Routes (B)

Designated truck routes will be established to govern how trucks reach the site. The main point of this commitment is to have trucks use only the regional highway system and major arteries and avoid using residential streets and historic districts. The truck routing plan will be designed to protect the North End, Charles River Park, Beacon Hill, and Charlestown residential areas, as well as the Bulfinch Triangle historic district. Similarly, the plan's intent will be to protect pedestrians in the general Causeway Street area through appropriate site access locations and restricting truck activity to that portion of Causeway Street necessary for the construction process. Enforcement of these restrictions will be accomplished through signage and contractual clauses in each contractor and subcontractor agreement.

Provide Covered Pedestrian Walkways (B)

Secure fencing, staging, and bracing will be provided in areas affected by each phase of construction to protect nearby pedestrian and vehicular traffic, and to improve safety. Gate entrances into each construction area will be determined jointly with the MBTA and the BTD.

Provide Adequate On-Site Storage Areas for Construction Materials (B)

The location of lay down and storage areas will be established to minimize area disruption and confusion. It appears that there will be opportunities for the creation of these areas throughout the site. At this point, it appears that the need for the construction contractor to be physically located on city streets will be quite limited. The peripheral locations will also likely serve as staging areas for many of the more internal areas of the site where construction will be occurring. The movement of materials across the site will be carefully planned to avoid disrupting abuttors. The proponent will direct the construction manager to investigate the possibility of constructing staging at a location remote from the project site.

Encourage Construction Workers to Use Public Transportation (B)

Construction workers will be encouraged to access the site by public transportation or ridesharing and, therefore, no special provisions are planned to accommodate the parking needs of construction workers on the site. It is planned that the construction contract agreements signed by the owner and the contractor will include specific language encouraging workers not to drive to the site. If workers choose to drive, they will not be permitted to park in the staging areas. Rather, they will be required to park in the nearby garages and pay the full rates normally charged to the public. If carpools of construction workers are formed, they will be entitled to the same benefits that other carpoolers receive. At the same time, construction worker shifts will be scheduled to avoid impacts on the commuter rush hours as much as possible. With the usual hours for construction occurring between 7:00 AM and 3:30 PM, traffic and transit impacts will occur during non-system peak hours, reducing project impacts.

Provide Truck Waiting Areas (B)

Truck waiting areas will be designated to avoid creating impacts on adjacent areas. On the site, Accolon Way appears to provide opportunities for truck waiting to occur away from busy areas. Further, the use of an off-site truck marshalling area for major events such as large concrete pours will be investigated.

Provide Police Officer Traffic Management (B)

Police officer traffic control may be necessary through most early phases of construction. The need for police officers will be determined jointly with the BTD and provided as required. Detail officers on assignment in the construction zone will be responsible for maintaining a safe and orderly flow of vehicles and pedestrians, as well as responding to any unforeseen events. Emergency vehicle access to the site will be assured throughout the entire construction process.

Develop a Construction Graphics Program (B)

The developer recognizes the potential impacts of construction on pedestrian circulation patterns through and around the site. To deal with this issue, the proponent is prepared to develop a graphics/signage program to direct pedestrians through the construction areas. The ongoing activities on the site must be allowed to continue in as unimpeded a fashion as possible. Keeping the Boston Garden, North Station, the retail areas, and other uses functioning with as little disruption as possible is an important goal of the project.

Coordinate With BTD in the Creation and Implementation of a Construction Traffic Management Plan (B)

The proponent will work with the Boston Transportation Department, along with other agencies such as the MBTA and MDPW, as well as groups such as the Downtown North Association and other area land owners and businessmen, to develop the construction traffic management plan mentioned above. The goal will be to create a comprehensive and realistic plan that is sensitive to the needs of those likely to be affected by project construction activities.

Access Goals and Monitoring

Implement a Transportation Monitoring Program in Response to the Boston Transportation Department's Requirements (C)

In a previous section, detailed estimates of the amount of vehicle-trip generation were made, based on several combined factors. The most significant factors affecting the number of vehicle trips to the commercial component are the percentage of automobile use versus transit/walk use, vehicle occupancy rate, and the percentage of trips arriving during the peak travel hours.

To minimize the amount of automobile travel to the site, it is desirable to increase the number of trips by public transportation and to increase the vehicle occupancy rate of those vehicles traveling to the site. It is also beneficial to decrease the peak hour travel percentage through various peak spreading techniques described earlier. These factors serve as a basis for establishing a set of access goals for the project.

Table IV-A-64 lists the trip generation factors for the commercial component, along with the values assumed for project-generated trips in the earlier section of this document. The factors focus on office work trips, which constitute most of the project's new vehicle- and transit-trip generation during the peak commuting hours. Changes in the value of each factor may be considered as measures of effectiveness for the proposed mitigation actions. The top portion of the table lists the numerical values of the key factors used in the unmitigated analysis and the revised factors, which assume the mitigation program is in place during both the 1995 (Interim-Build) and 2000 (Full-Build) analysis conditions. The 1995 goals are more modest than those for 2000 since the project is just starting to come on line and will not have an extended opportunity to generate full benefits from the program. The lower part of the table shows both the originally expected, net new office work trip generation and the revised estimates, which assume the mitigation plan is in place.

Table IV-A-64 ACCESS GOALS - COMMERCIAL COMPONENT

	1995 Unmitigated Analysis Estimate	2000 Unmitigated Analysis Estimate	Mitigation Action	1995 Mitigation Goal	2000 Mitigation Goal
Trip Generation Factors					
Percent by Transit	66%	66%	Transit Incentives	67%	70%
Vehicle Occupancy Rate	1.50	1.50	Ridesharing	1.60	1.80
Peak Hour Percentage:					
Inbound Morning	50%	50%	Alternative	48%	45%
Outbound Evening	42%	42%	Work Schedules	40%	40%
Resulting New Peak Hour Office Work Trips					
Vehicle Trips:					
Morning In	314	739		273	479
Evening Out	264	623		228	428
Transit Trips:					
Morning In	1,071	2,524		1,044	2,410
Evening Out	902	2,128		872	2,150

As indicated in the table, mitigation measures reduce 1995 (Interim-Build) project-generated vehicle trips made by office workers in the peak direction by approximately 41 vehicles (13 percent) in the morning peak hour and 36 vehicles (14 percent) in the evening peak hour. Office worker transit trips decrease marginally in the morning and evening peak hours (about 3 percent) due largely to the peak hour spreading affect of alternative work schedules. For 2000 (Full-Build) conditions, larger benefits will accrue compared to the unmitigated condition. Percentage decreases for vehicle trips range from 31 to 35 percent. Transit trips will decrease by about 5 percent in the morning and will increase by about 1 percent in the evening.

As a follow up to the setting of the access goals listed above, the developer is prepared to provide annual management reports to the city on the project's compliance with the stated goals and objectives, as well as other areas of the access plan. To accomplish this, the proponent will conduct an annual survey of employees and other users of the commercial component, starting with completion of the new arena and occupancy of the first phase building. These surveys will be used to assist in determining trip generation rates, travel mode splits, vehicle occupancy rates, peak hour travel percentages, and parking data. Additionally, data on trip origins and destinations will be gathered as part of the survey work. These data will be collected after consultation with the BTD and in accordance with the BTD's guidelines.

B Air Quality

INTRODUCTION

The objective of this analysis is to determine if the construction of the proposed New Boston Garden Development will interfere with the attainment and maintenance of Massachusetts and National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO). The study consists of a microscale intersection analysis and a parking garage analysis.

The results of these analyses indicate that the New Boston Garden Development will not have a significant impact on the attainment of air quality goals in the project area. Concerning project-related traffic, worst case meteorology and peak traffic conditions were examined. Improvements in the area transportation system, continued implementation of the Massachusetts Vehicle Inspection and Maintenance program, and traffic signal optimization result in 2000 Full-Build conditions without any air quality violations. This represents an improvement in air quality in comparison to 1990 Existing conditions. The analysis of conditions in the project Garage and at sensitive receptors near its exhaust vents indicates there will be no adverse effects. Dust emissions during construction will be controlled through a program of proposed mitigation measures.

Air Quality Regulations and Standards

NAAQS for carbon monoxide have been set by the US Environmental Protection Agency (EPA). Standards for the Commonwealth of Massachusetts are identical to the federal standards. The standards set a maximum concentration of 35 parts per million (ppm) for a 1-hour period and 9 ppm for an 8-hour period, each not to be exceeded more than once per year. The City of Boston is currently classified by the EPA as not being in "attainment" of the NAAQS for CO, although Department of Environmental Protection (DEP) monitoring data show the City has been in compliance with the NAAQS since the beginning of 1987. Air quality conditions do vary within the city, and it is important in each project analysis to understand the conditions in the study area, the possible sensitive receptors, and the places where air quality changes may result.

The NAAQS were established under the Federal Clean Air Act and are designed to protect public health and welfare. To demonstrate compliance, it is necessary to identify those areas of human activity (receptors) exposed to maximum air pollutant levels from motor vehicle emissions in the project area. Using air quality modeling techniques, CO levels are estimated at these receptors in the microscale analysis for existing and future conditions. Comparison of projected pollutant levels to the NAAQS permits evaluation of whether motor vehicle emissions related to the proposed development will result in air pollution levels that exceed the NAAQS.

The key source of project-related air pollution is emissions from motor vehicles in the vicinity of the site. Carbon monoxide is used as an indicator of roadway air pollution levels since it is the most abundant and persistent pollutant emitted by motor vehicles. Also, since CO reacts slowly, its concentration in the air can be easily predicted.

The adverse health effects of carbon monoxide are a result of its combination with blood hemoglobin to form carboxyhemoglobin (COHb). This compound interferes with the life-sustaining transfer of oxygen from the lungs to the body tissues and the return of carbon dioxide from the tissues to the lungs. The presence of relatively small amounts of CO results in significant interference with essential cardiovascular respiratory functions. Brief exposure to high levels of CO can impair vision, physical coordination, and the perception of time. The NAAQS have been established in an effort to keep ambient CO levels below the level that would trigger these health effects.

Background Air Quality

In an urban area such as Boston, there is always a fairly constant and diffuse level of CO in the air due to the numerous sources throughout the region and beyond. Such sources include all stationary fuel combustion facilities as well as motor vehicle emissions on roadways. This diffuse level of air pollution is called the background level. It is necessary to determine the background CO level in this study so that it can be added to the impact of local sources (namely, roadway intersections in the study area, the project Garage exhaust, and the MBTA garage exhaust) to determine whether air quality at a particular location complies with the NAAQS.

Background air quality can be determined by monitoring and testing air samples. There are no continuous air monitoring stations near the project site, although DEP does have several such stations in the City of Boston.
Table IV-B-1 shows ambient monitoring data from those DEP stations judged to be most representative of the project site with respect to pollutants for which the EPA and DEP have established health standards. Besides CO, these pollutants include sulfur dioxide (SO2), nitrogen dioxide (NO2), ozone (O3), total suspended particulate (TSP), 10-micron particulate matter (PM10), and lead (PB). For averaging periods less than one year, the values shown in Table IV-B-1 are the second highest reported values used to determine compliance with the NAAQS. As such, these values cannot be applied as background values since they are relatively extreme and do not represent average conditions. Data for 1989 were not available at the time of this writing, so the years of 1986 through 1988 are presented. Background levels of CO in the study area have been conservatively estimated by the DEP to be no more than 5 ppm for a 1-hour average and 3 ppm for an 8-hour average for the project site.

Table IV-B-1 **AMBIENT AIR QUALITY MEASUREMENTS IN BOSTON FOR 1986, 1987, AND 1988**

Pollutant	Averaging Time	Location	1986 (ug/m^3)	1987 (ug/m^3)	1988 (ug/m^3)	NAAQS (ug/m^3)
SO2	3 hours	Kenmore Square	363	272	306	1,300
	24 hours		141	128	149	365
	Annual		42	44	47	80
TSP	24 hours	Columbus Avenue	197	112	115	150
	Annual		72	63	59	75
PM10	24 hours	Columbus Avenue	75	59	64	150
	Annual		40	30	31	50
PB	3 hours	Kenmore Square	0.2	0.1	0.1	1.5
NO2	Annual	Kenmore Square	64	71	68	100
CO*	1-hour	Washington Street	16.0	11.0	10.0	35
	8-hour		10.4	7.1	5.9	9
O3	1-hour	Chelsea	241	228	294	235

Note: Second highest values are shown for averaging times that are 24 hours or less.
Source: 1986, 1987, 1988 Annual Reports on Air Quality in New England: US EPA, New England Regional Laboratory; Lexington, Massachusetts.
* Units equal parts per million.

MICROSCALE INTERSECTION ANALYSIS

Modeling Approach

A microscale analysis was performed to determine the impact of the proposed New Boston Garden Development on air quality at intersections in the vicinity of the site. The technical approach used to predict the microscale ambient air quality was reviewed in advance with the Massachusetts DEP and the Boston Redevelopment Authority (BRA).[1] The analysis calculated maximum 1-hour and 8-hour CO concentrations for the following five conditions:

- 1990 Existing conditions
- 1995 No-Build conditions
- 1995 Interim-Build conditions
- 2000 No-Build conditions
- 2000 Full-Build conditions

1/ Personal communication with Mr. Richard Mertens of the Boston Redevelopment Authority and Mr. Gary Idleburg of the Massachusetts DEP, Division of Air Quality Control in Boston, MA on August 30, 1990.

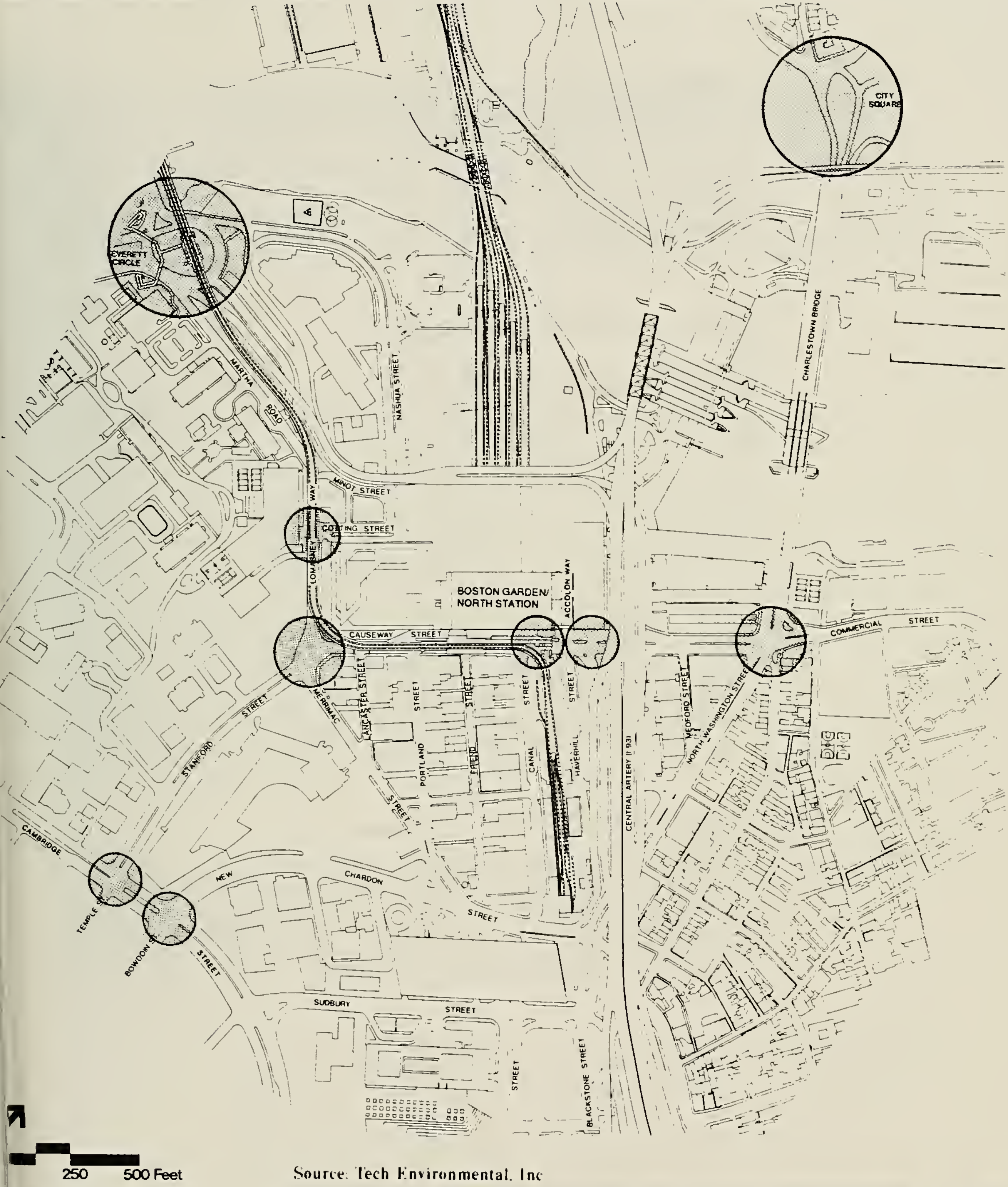
The MEPA and BRA scopes (see Chapter VII, MEPA and BRA Documents) established a list of thirteen intersections to be considered as part of the traffic analysis. As required by each scope, a microscale air quality analysis of CO levels was performed for those intersections where level of service (LOS) is expected to deteriorate to D and the project adds 10 percent or more to the traffic volume, or where the LOS is E or F and the project contributes to a reduction in level of service. Using these criteria, the following intersections were chosen for analysis for 1990, 1995, and 2000, unless otherwise noted:

- Leverett Circle (1990 and 1995 only)
- Lomasney Way and Cotting Way (1990 only)
- Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street
- Causeway Street and Canal Street
- Causeway Street, Haverhill Street, and Accolon Way
- Causeway Street, North Washington Street, and Commercial Street
- City Square in Charlestown
- Cambridge Street, Staniford Street, and Temple Street
- Cambridge Street, New Chardon Street, and Bowdoin Street

The location of each intersection is shown in Figure IV-B-1. The configuration of some of these intersections will change between 1990 and 2000 (as a result of planned state and city transportation improvements), specifically:

- Leverett Circle is redesigned in 2000 and has a greatly improved level of service in that year, which exempts it from the requirement for an air quality analysis.
- The reconstruction of Nashua Street removes the intersection of Lomasney Way and Cotting Way in future years. The intersection of Nashua Street and Lomasney Way has an improved level of service which exempts it from the requirement for an air quality analysis.
- Merrimac Street becomes a two-way street for the 1995 and 2000 analyses.
- I-93 ramps near the intersection of Causeway Street, Haverhill Street, and Accolon Way are included in the 1990 and 1995 analyses, but are removed in the year 2000.
- As part of the Central Artery North Area (CANA) project, City Square is reconstructed by 1995 for the 1995 and 2000 analyses.
- The northbound I-93 off-ramp to Leverett Circle is removed for the analyses of the year 2000.

Traffic volumes assigned to these intersections were derived from the traffic analysis presented in the Technical Data appendix.



Source: Tech Environmental, Inc

Air Quality Receptors and Study Locations

Figure IV-B-1

Two mathematical models were used to predict CO concentrations. The first, MOBILE4,[2] was used to calculate the emission of CO at intersections based on traffic flows. The second model, CALINE-3,[3] was used to predict concentrations of CO at sensitive human receptors near each intersection. A detailed description of the technical approach and the assumptions used in the analysis is given in the Technical Data appendix. The receptor locations and intersection geometry are shown in Figures IV-B-2 through IV-B-12 which are presented at the end of this chapter.

Intersection Results and Conclusions

The air quality analysis predicted maximum 1-hour and 8-hour CO concentrations at receptors located near roadway intersections. Details of the analysis are included in the Technical Data appendix. The results of the air quality analysis, including impacts from intersection traffic and background carbon monoxide, are presented in Tables IV-B-2 and IV-B-3. These results do not characterize typical or average air pollution levels in the project area. Rather, they represent the highest concentrations that could exist during the joint occurrence of worst case meteorology and peak traffic. These results are for each intersection before any mitigation measures were applied.

The modeling results generally indicate a reduction in predicted CO concentrations between 1990 and 2000. This reduction is expected as a larger portion of the vehicle population becomes equipped with full emission control equipment and a larger portion of the vehicle population is held to stricter emission limits through the Commonwealth's Inspection and Maintenance program. Tables which document the predicted reduction in composite and idle CO emission rates from 1990 to 2000 are located in the Technical Data appendix.

Existing Conditions (1990)

The modeling results for Existing conditions indicate maximum 1-hour CO concentrations in the range of 10.4 to 29.3 ppm. The maximum predicted 1-hour CO concentrations are all in compliance with the 1-hour NAAQS for CO. Eight-hour maximum predicted CO concentrations ranged between 4.9 and 15.0 ppm. The modeling indicates that maximum CO levels at four intersections may presently exceed the 8-hour NAAQS for CO.

2/ User's Guide to MOBILE-4 (Mobile Source Emission Factor Model, EPA-AA-TEB-89-01; EPA; Ann Arbor, MI (February 1989).

3/ CALINE-3, A Versatile Dispersion Model for Predicting Air Pollutant Levels Near Highways and Arterial Streets, FHWA/CA/TL-79/23; California Department of Transportation; Sacramento, CA (November 1979).

Table IV-B-2 MAXIMUM PREDICTED 1-HOUR CARBON MONOXIDE CONCENTRATIONS FOR INTERSECTIONS PLUS BACKGROUND (PPM)*

Intersection	1990 Build	1995 No-Build	1995 Interim-Build	2000 No-Build	2000 Full-Build
Leverett Circle	24.4	15.2	15.1	**	**
Lomasney Way and Cotting Way	14.1	***	***	***	***
Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street	13.6	11.6	11.8	11.0	11.2
Causeway Street and Canal Street	10.4	8.9	9.0	8.7	8.8
Causeway Street, Haverhill Street, and Accolon Way	14.0	11.2	11.5	14.9	15.4
Causeway Street, North Washington Street, and Commercial Street	29.3	19.2	19.3	16.4	16.6
City Square in Charlestown	16.3	18.3	18.5	16.1	16.5
Cambridge Street, Staniford Street, and Temple Street	20.7	13.8	13.9	13.9	13.9
Cambridge Street, New Chardon Street, and Bowdoin Street	23.4	17.3	17.3	14.9	14.9
NAAQS+	35.0	35.0	35.0	35.0	35.0

* Pre-mitigation data.
** Leverett Circle is redesigned in year 2000 and has a greatly improved level of service which exempts it from the requirement for an air quality analysis.
*** This intersection does not exist in 1995 and 2000.
+ National Ambient Air Quality Standard.

The highest predicted existing 8-hour CO concentration (15.0 ppm) occurred at the Causeway Street, North Washington Street, and Commercial Street intersection. The air quality modeling is designed to overpredict maximum CO levels. For that reason, if measurements were to be taken at this intersection for an entire year, it is likely that the actual peak levels would be lower. Nevertheless, the model results indicate the possibility of air quality violations at this intersection and at three other intersections.

Table IV-B-3 MAXIMUM PREDICTED 8-HOUR CARBON MONOXIDE CONCENTRATIONS FOR INTERSECTIONS PLUS BACKGROUND (PPM)*

Intersection	1990 Build	1995 No-Build	1995 Interim-Build	2000 No-Build	2000 Full-Build
Leverett Circle	12.4	8.5	8.5	**	**
Lomasney Way and Cotting Way	6.1	***	***	***	***
Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street	7.6	6.6	6.6	6.2	6.2
Causeway Street and Canal Street	4.9	4.4	4.5	4.5	4.5
Causeway Street, Haverhill Street, and Accolon Way	7.9	6.3	6.6	4.6	5.1
Causeway Street, North Washington Street, and Commercial Street	15.0	9.8	10.2	8.4	8.9
City Square in Charlestown	7.5	9.8	10.0	9.0	9.0
Cambridge Street, Staniford Street, and Temple Street	11.1	7.6	7.7	7.5	7.5
Cambridge Street, New Chardon Street, and Bowdoin Street	11.2	7.5	7.5	7.3	7.3
NAAQS+	9.0	9.0	9.0	9.0	9.0

Note: Underlined values indicate a violation of the standard.
* Pre-mitigation data.
** Leverett Circle is redesigned in year 2000 and has a greatly improved level of service which exempts it from the requirement for an air quality analysis.
*** This intersection does not exist in 1995 and 2000.
+ National Ambient Air Quality Standard.

1995 No-Build

The modeling results for the 1995 No-Build conditions indicate maximum 1-hour CO concentrations between 8.9 and 19.2 ppm and maximum 8-hour CO concentrations between 4.4 and 9.8 ppm. The maximum predicted 1-hour CO concentrations are all in compliance with the 1-hour NAAQS. The results indicate violations of the 8-hour NAAQS for CO may continue in 1995 under the No-Build conditions at two intersections--City Square and Causeway Street, North Washington Street, and Commercial Street. The modeling results show a substantial improvement in air quality at the latter intersection from 1990 to 1995, but not enough to obtain compliance. Air quality at City Square appears to deteriorate between 1990 and 1995. This is due to the redesign of the intersection and the fact that it will be handling much larger volumes of traffic in the future.

1995 Interim-Build (Pre-Mitigation)

The modeling results for the 1995 Interim-Build conditions (the New Boston Garden and Building C) are almost identical to the 1995 No-Build results and indicate maximum 1-hour CO concentrations between 9.0 and 19.3 ppm and maximum 8-hour CO concentrations between 4.5 and 10.2 ppm. These results indicate compliance with the 1-hour NAAQS for CO and a possible continuation of violations of the 8-hour NAAQS at two intersections. The project traffic will add between 0.0 and 0.4 ppm to maximum 8-hour CO levels, and thus, will not have a significant impact on air quality.

2000 No-Build

The modeling results for the 2000 No-Build conditions are very similar to those for the 2000 Full-Build case. The maximum predicted 1-hour CO concentrations ranged from 8.7 to 16.4 ppm, and the maximum predicted 8-hour CO concentration ranged from 4.5 to 9.0 ppm. These results indicate compliance with both the 1-hour and 8-hour NAAQS for CO. The NAAQS is violated only when the second highest 8-hour CO level in a year exceeds 9 ppm. The modeling results represent a conservative (overestimated) value for the highest 8-hour CO level in the year at each receptor point. The second highest value will always be lower. Thus, although it appears marginal, the predicted 8-hour maximum CO level of 9.0 ppm is in compliance.

2000 Full-Build (Pre-Mitigation)

The modeling results for the 2000 Full-Build conditions indicate maximum 1-hour CO concentrations which range between 8.8 and 16.6 ppm and maximum 8-hour CO concentrations which range between 4.5 and 9.0 ppm. These results indicate compliance with both the 1-hour and 8-hour NAAQS for CO. The project traffic will add between 0.0 and 0.5 ppm to peak hour 8-hour levels, and thus, will not have a significant impact on air quality.

Mitigation Measures for Microscale Analysis

The modeling results shown in Table IV-B-3 indicate that violations of the 8-hour NAAQS for CO may occur at two intersections for the 1995 No-Build and 1995 Interim-Build cases and that CO levels at one intersection are marginally in compliance in the year 2000. Measures were therefore sought to reduce the impact of motor vehicle traffic on air quality at these intersections. The recommended measures are discussed below, and the results of modeling the Interim-Build and Full-Build cases with mitigation are shown in Table IV-B-4.

Table IV-B-4 **MAXIMUM PREDICTED 8-HOUR CARBON MONOXIDE CONCENTRATIONS PLUS BACKGROUND WITH MITIGATION MEASURES APPLIED (PPM)**

Intersection	Conditions	CO Concentration (ppm)
Causeway Street, North Washington Street, and Commercial Street	1995 Interim-Build	8.7
City Square in Charlestown	1995 Interim-Build	8.6
	2000 Full-Build	8.6
NAAQS*		9.0

* National Ambient Air Quality Standard.

Causeway Street, North Washington Street, and Commercial Street Intersection Under 1995 Interim-Build Conditions

Changes to signal timing will bring this intersection into compliance with the NAAQS for CO by reducing the maximum predicted 8-hour CO concentration from 10.2 to 8.7 ppm. The signal timing proposed in the Technical Data appendix gives 30 seconds of protected green time to both Causeway Street and Commercial Street. The signal timing, which is proposed as mitigation, allows Causeway Street in the evening peak hour to move for 25 seconds of protected green time followed by 35 seconds of shared green time for both Causeway and Commercial streets.

City Square, Charlestown Intersection Under 1995 Interim-Build Conditions

This intersection will be completely redesigned by 1995 as part of the CANA project. The new City Square intersection is projected to have an 8-hour CO concentration above the NAAQS at the corner of Rutherford Avenue and Chelsea Street, whether or not the New Boston Garden Development is built. This is a short-term problem since the modeled violation disappears by the year 2000 due to the continuing decrease in motor vehicle emission rates. In 1995, though, this modeled violation may occur, and it must be emphasized that it will not be caused by the New Boston Garden Development, as the project's contribution to the total CO level at City Square (0.4 ppm) is miniscule. Nevertheless, in order to protect public health, an examination of mitigation measures was made.

Since this is not a new intersection for which the project proponent is responsible, no changes to geometry can be put in place. The signal timing was checked and found to be balanced, i.e., it already minimizes delays. Reduction in the cycle length from 150 to 120 seconds was tested as a mitigation measure. Although this would reduce overall delays somewhat, predicted CO concentrations do not come into compliance by means of this measure alone. Mitigation for this short-term problem, therefore, focused on actual land uses.

Since plans for the future land use of all areas around this intersection are not certain at this time, model receptors were placed all around the intersection at the minimum setback distance of 3 meters. The modeled violation of the 8-hour

NAAQS for CO is predicted to occur at the receptor between Rutherford Avenue and Chelsea Street (6 meters east of Rutherford Avenue and 3 meters north of Chelsea Street). It was found that if the receptor were moved 4 meters further north (away from Chelsea Street), that the maximum predicted 8-hour CO concentration at the receptor would be reduced to 8.6 ppm, a value in compliance with the NAAQS. Since this intersection has not yet been constructed and the future land use for this quadrant of the intersection has yet to be determined, it is recommended that uses that would place people in the area for as long as 8 hours (e.g., a building) not be planned any closer than 7 meters from the edge of Chelsea Street near the corner with Rutherford Avenue. By the year 2000, this restriction is no longer necessary.

City Square, Charlestown Intersection Under 2000 Full-Build Conditions

The modeling results show this intersection is marginally in compliance with the 8-hour NAAQS for CO. Changes to the total signal cycle length were explored as a mitigation measure. In the Technical Data appendix, the recommended cycle length is 180 seconds. This was reduced to 120 seconds, and all green time was scaled proportionally to maintain balanced timing. This change reduces vehicle delays on most of the approach legs and reduces the maximum predicted 8-hour CO concentration from 9.0 to 8.6 ppm.

With the proposed mitigation measures, all maximum predicted CO concentrations will be in full compliance with the NAAQS. It can also be concluded that the New Boston Garden Development will not interfere with the attainment and maintenance of the NAAQS for CO.

PARKING GARAGE ANALYSIS

There are no air quality impacts related to the project Garage for the New Boston Garden alone. The project Garage and its impacts are a part of the commercial component. This section 1) describes the ventilation and exhaust system for the project Garage; 2) predicts the impact of garage exhaust on pedestrian-level air quality; and 3) describes any mitigation measures needed to avoid violation of air quality standards. The impact assessment focused on predicting the maximum 1-hour and 8-hour CO concentrations at sensitive receptors near the exhaust vents for the 2000 Full-Build conditions when traffic volumes in the garage will be highest.

Garage Ventilation System

The New Boston Garden Development garage and the MBTA garage are planned to operate as a single parking structure containing 2,400 spaces. Of these, 1,100 parking spaces will be built in the project portion of the garage covering a total of six levels and 400,000 square feet of floor area. An additional 1,300 spaces will exist in the MBTA portion of the garage. The project Garage will be ventilated at a rate higher than the minimum required by the Massachusetts State Code Section 413.3.1 and the 1987 BOCA National Mechanical Code. The ventilation rate will be 4.7 cubic feet per minute (cfm) per square feet of floor area. Fresh air drawn in from the pedestrian street between Building B and the GSA Building will be delivered at the rate of 1,880,000 cfm to the project Garage. Exhaust air will be vented at the same flow rate through two louvered areas of 250 square feet each at a velocity of 63 feet per second. The exhaust vents will be located 35 to 45 feet above grade on either side of the main portal entrance to the Public Concourse on Causeway Street.

Although the total traffic and its circulation in both the project Garage and the MBTA garage have been considered in this impact analysis, this Draft EIR/PIR discusses only the effects of the ventilation exhaust from the New Boston Garden Development garage and not the ventilation exhaust from the MBTA garage. The two ventilation systems will exhaust at locations which are at opposite ends of the building site. The MBTA exhaust vents will be on the north face of the New Boston Garden overlooking the commuter rail tracks and near the northeast corner of the arena, overlooking the air space above the depressed Central Artery. For that reason, the local impacts of the two sets of garage vents are not additive and the impacts of the MBTA garage are included in the background level for this assessment.

Peak Period Traffic Volumes

The New Boston Garden Development garage and the MBTA garage will be served by two entrance lanes from the Lomasney Way and Nashua Street intersection, one entrance lane from Causeway Street, two exit lanes to Nashua Street, and one exit lane to Causeway Street. Internally, a total of seven booths will be used in various in/out combinations to service garage patrons. During workday hours, patrons will stop at a booth with a gate and pay before exiting the garage. During a Boston Garden event, however, people using the garage will pay upon entering so that the garage can be emptied rapidly afterwards. Drivers exiting after a Boston Garden event will simply leave the garage without stopping to pay parking charges. The entrance lane on Causeway Street will also be reversible so that, for a large event, a total of four exiting lanes are available.

The peak 1-hour period for CO emissions in the garage will be the hour following a large Boston Garden event. As a worst case, it is assumed that all 2,400 spaces in the combined garages will empty out within one hour. The exit volume, split over four lanes, represents a per lane volume of 600 vehicles per hour (vph). The ramp lanes will be able to accommodate this volume since no gating will occur. When exiting cars reach the street level, their movements will be managed by traffic control officers provided by the proponent.

The peak 8-hour period for CO emissions in the garage will occur from 3:00 PM to 11:00 PM on a weekday when a Boston Garden event lets out after 10:00 PM. This period will include both the evening peak hour as well as event conditions. In projecting the traffic volumes, it is assumed that 200 cars parked earlier in the day will remain parked in the garage past the evening peak hour for the Boston Garden event. A total of 2,200 vehicles will, therefore, enter between 3:00 PM and the start of the event at 7:30 PM to fill the other spaces completely. Most of the traffic exiting the garage will leave during the two hours of 5:00 to 6:00 PM and 10:00 to 11:00 PM, although some exit movements will occur in the "shoulder" hours of the evening peak. The following traffic volumes for the 2000 Full-Build conditions were used in the analysis:

- Peak 1-hour of 10:00 to 11:00 PM:
  - -- Entering vehicles = 0
  - -- Exiting vehicles = 2,400

- Peak 8-hours of 3:00 to 11:00 PM:
  - -- Entering vehicles = 2,200
  - -- Exiting vehicles = 4,264

- Average hour of the peak 8-hour period:
  - -- Entering vehicles = 275
  - -- Exiting vehicles = 533

For the hours not related to the end of the Boston Garden event, the garage will operate in a normal mode with one exit lane and two pay booths on Causeway Street and two exit lanes and four pay booths on Nashua Street. Each pay booth will have a gated capacity of 180 to 360 vph for a total garage exit capacity of 1,080 to 2,160 vph. As a conservative assumption, the lower number was used in this analysis.

Motor Vehicle Emission Rates

The EPA MOBILE4 emissions model was used to calculate single vehicle CO emission rates for an average garage speed of 10 mph, of 11.55 grams per minute (gpm), and 8.94 gpm for the peak 1-hour and 8-hour periods in 2000, respectively. MOBILE4 results are provided in the Technical Data appendix. For the peak 1-hour period it is assumed that 100 percent of the cars are in a cold start mode. For the peak 8-hour period, all exiting vehicles are assumed to be in a cold start mode, while those entering have a cold/hot start profile equal to urban default values specified by EPA. The resulting percentages for the peak 8-hour period are 73.0 percent cold start and 9.3 percent hot start.

The next step was to estimate, using the EPA Volume 9 guidelines,[4] the amount of time a motor vehicle will be in the garage when its engine is running. From preliminary plans, it was calculated that it will take the following number of minutes on average, for a car to enter the garage and park, or back out of its space and exit the garage:

- Peak 1-hour exit time = 10.0 minutes

- Peak 8-hour enter time = 2.8 minutes

- Peak 8-hour exit time = 3.0 minutes

/ Guidelines for Air Quality Maintenance Planning and Analysis, Volume 9 (Revised): Evaluating Indirect Sources; US EPA 450/4-78-001 (1978).

Based on this analysis, total CO emission rates in grams per second (gps) for the New Boston Garden portion of the garage are projected to be:

- Peak 1-hour = 35.3 gps
- Peak 8-hour = 2.7 gps

Predicted CO Concentrations

Based on the volumetric flow rates for the New Boston Garden Development garage, CO concentrations in the garage exhaust air for the 2000 Full-Build conditions are projected (in parts per million, or ppm) to be:

- Peak 1-hour = 34.6 ppm
- Peak 8-hour = 2.6 ppm

These are the maximum concentrations projected to occur in the garage exhaust. Since "ambient air" is defined by EPA to be "that portion of the atmosphere, external to buildings, to which the general public has access", the NAAQS do not apply to the interior of the garage. For indoor exposure to air pollution, limits have been set to protect the health of workers by three different organizations. These limits assume a worker will be exposed 8 hours per day, 40 hours per week. The American Conference of Governmental Industrial Hygienists has adopted threshold limit values for carbon monoxide of 50 ppm (8-hour average) and 400 ppm (short-term ceiling). The National Institute for Occupational Safety and Health (NIOSH), US Department of Health and Human Services has published Recommended Exposure Limits of 35 ppm (8-hour average) and 200 ppm (short-term ceiling). The Occupational Safety and Health Administration (OSHA), US Department of Labor has adopted limits identical to NIOSH's. For the general public inside an enclosed structure such as a garage or tunnel, U.S. EPA guidance recommends CO levels not to exceed 120 ppm for an exposure period up to 15 minutes, and not exceed 35 ppm for a period of 1 hour. Using the lowest of these recommended exposure limits (35 ppm), it can be seen that the concentrations of CO in the garage exhaust air are in compliance with these recommended limits, and garage patrons and workers will not be exposed to hazardous levels of CO.

The impact of the garage exhaust on ambient air quality (outdoor air quality) in the pedestrian area in front of the Public Concourse entrance on Causeway Street was calculated using the Halitsky model for wake cavity dilution. This approach assumes a typical building downwash circulation for the air space between the exhaust vent above the portal entrance and people in the pedestrian area below. Three sensitive receptors were selected for purposes of this analysis:

- A person standing at the portal entrance directly below the exhaust vent (this is the same location as the "Future Public Concourse Entrance" receptor at the intersection of Causeway Street and Canal Street (see Figure IV-B-6)
- The "Sports Cafe" receptor at the intersection of Causeway Street and Canal Street (see Figure IV-B-6)

- The "Shoe Repair" receptor at the intersection of Causeway Street, Haverhill Street, and Accolon Way (see Figure IV-B-7)

Assumptions used in the Halitsky model include a conservative (low) turbulence factor of 2.0, a minimum wind speed of 1.0 meters per second, and the minimum transport distances from the center of each exhaust vent to breathing height in the pedestrian area below.

The modeling results are summarized in Table IV-B-5. The total impact from garage exhaust, roadway intersections, and urban background levels is shown in this table. These maximum 1-hour and 8-hour CO concentrations are all in compliance with the NAAQS.

Mitigation Measures for the Parking Garage

The operation of the project parking garage, even under the worst case of a large Boston Garden event, will not adversely affect air quality at any of the sensitive receptors examined. Since no adverse effects will occur, mitigation measures specific to the parking garage are not needed.

Table IV-B-5 **PREDICTED MAXIMUM CO CONCENTRATIONS (PPM) FOR THE 2000 FULL-BUILD CONDITIONS AT THREE SENSITIVE RECEPTORS NEAR THE PROJECT GARAGE EXHAUST VENTS**

	Receptor Location		
	Public Concourse Entrance	Sports Cafe	Shoe Repair
Peak 1-Hour:			
Garage Impact	12.8	12.1	9.4
Intersection Impact	3.2	3.8	10.4
Background	5.0	5.0	5.0
TOTAL	21.0	20.9	24.8
NAAQS	35.0	35.0	35.0
Peak 8-Hour:			
Garage Impact	1.0	0.9	0.7
Intersection Impact	1.2	1.3	2.1
Background	3.0	3.0	3.0
TOTAL	5.2	5.2	5.8
NAAQS	9.0	9.0	9.0

AIR QUALITY DURING CONSTRUCTION

The construction-related air quality impacts described in this section will occur principally during construction of the commercial component of the project and not during construction of the New Boston Garden. The primary reason there will be no significant air quality impacts from construction of the New Boston Garden is that the building will be erected on an at-grade concrete slab that the MBTA will have constructed, and no new excavation will be required. The only air pollutant emissions associated with construction of the New Boston Garden will be the exhaust from trucks bringing materials to the site and the diesel-powered construction equipment on site. Compared to motor vehicle traffic on nearby streets, these emissions are insignificant.

During the construction of the commercial component of the New Boston Garden Development, short-term air quality effects will result from fugitive dust emissions, which will cause increased local concentrations of Total Suspended Particulates (TSP) and 10-micron Particulate Matter (PM10). The major sources of particulate matter will be demolition of the existing Boston Garden, excavation for the project Garage, and exposed aggregate storage piles. The amount of such emissions will depend on many factors, including soil silt and moisture content, the surface area exposed, demolition and construction practices, and local meteorology. In all cases, fugitive dust emissions require a dry emitting surface. Thus, emissions are proportional to the regional Precipitation/Evaporation (PE) index, a measure of the precipitation to evaporation ratio. In the eastern United States, the PE index ranges from a low of 90 in Florida to a high of 170 in upstate New York. In the Boston area, the PE index is 132. Using EPA emissions factors adjusted for the local PE index, construction and demolition operations will generate a maximum of 11 pounds of dust per acre per day. Construction of the New Boston Garden Development will proceed over a ten-year period in conjunction with many other public works projects. Fugitive dust emissions will occur primarily during 1993 and 1994, when demolition and excavation will take place. The existing Boston Garden will be demolished using standard mechanical techniques and equipment; no explosives will be used. During most of the time of excavation of the 2-acre site for the project Garage, an at-grade concrete slab supported by slurry walls and caissons will isolate the excavation activity from the open air and prevent most fugitive dust emissions. During the short period of time when the 2-acre site is totally open, maximum uncontrolled particulate matter emissions of 22 pounds per day could occur.

As required by the Massachusetts Department of Environmental Protection (DEP) Air Pollution Control Regulation 7.09, dust will be controlled during construction and demolition as needed by water spray. Water spray provides an approximate reduction of 50 percent in dust emissions during construction and will be used in conjunction with all activities that disturb the soil above the water table line on days when the surface is dry and exposed. The spread of fugitive dust off-site will also be reduced by the "up-down" method of construction and fencing used around the perimeter to shield public areas from construction activities. Water spray will also be used during the demolition of the existing Boston Garden.

Additional temporary air quality impacts are expected to result from the exhaust of construction vehicles operating on site and from trucks traveling to and from the site. During the peak period of excavation, a total of approximately 100 truck loads per day of excavate will be removed from the site by diesel-powered trucks. Carbon monoxide (CO) emissions, which cause the greatest local impacts, for one diesel-powered truck or piece of equipment are typically less than the CO emissions from one automobile. Thus, the total CO emissions from construction vehicles on site during the peak period will not be significant when compared to emissions from automobiles on nearby streets.

The short-term air quality impacts of the controlled fugitive dust emissions during the 1994 excavation were estimated using the area source model in the EPA Volume 9 Guideline and the 24-hour time scaling factor in the EPA Volume 10 Guideline. Maximum 24-hour TSP concentrations were predicted for three sensitive receptors near the construction site and are shown in Table IV-B-6.

Table IV-B-6 **TSP CONCENTRATIONS NEAR THE CONSTRUCTION SITE**

Sensitive Receptor	TSP Concentration ug/m^3
GSA Building Entrance at Lowell Square	13 ug/m^3
MBTA Station Entrance on Canal Street	7 ug/m^3
Spaulding Rehabilitation Hospital	3 ug/m^3

These results show that maximum 24-hour TSP concentrations from construction activities will be greatest at the GSA Building adjoining the development site and substantially less at the MBTA station entrance (and in the commercial area) south of Causeway Street. The lowest concentrations are predicted at the Spaulding Rehabilitation Hospital, which is further away from the construction site.

The maximum impact at the GSA Building of 13 ug/m^3 is 9 percent of the Massachusetts and National Ambient Air Quality Standards (NAAQS) of 150 ug/m^3 for TSP and PM10. The maximum impact at the Spaulding Hospital is only 2 percent of the NAAQS. These maximum impacts will only be temporary and will only occur for the period of time before the at-grade concrete slab for the project Garage is completed. On any given day when there is substantial precipitation or snow cover, fugitive dust emissions from the construction site will be essentially zero.

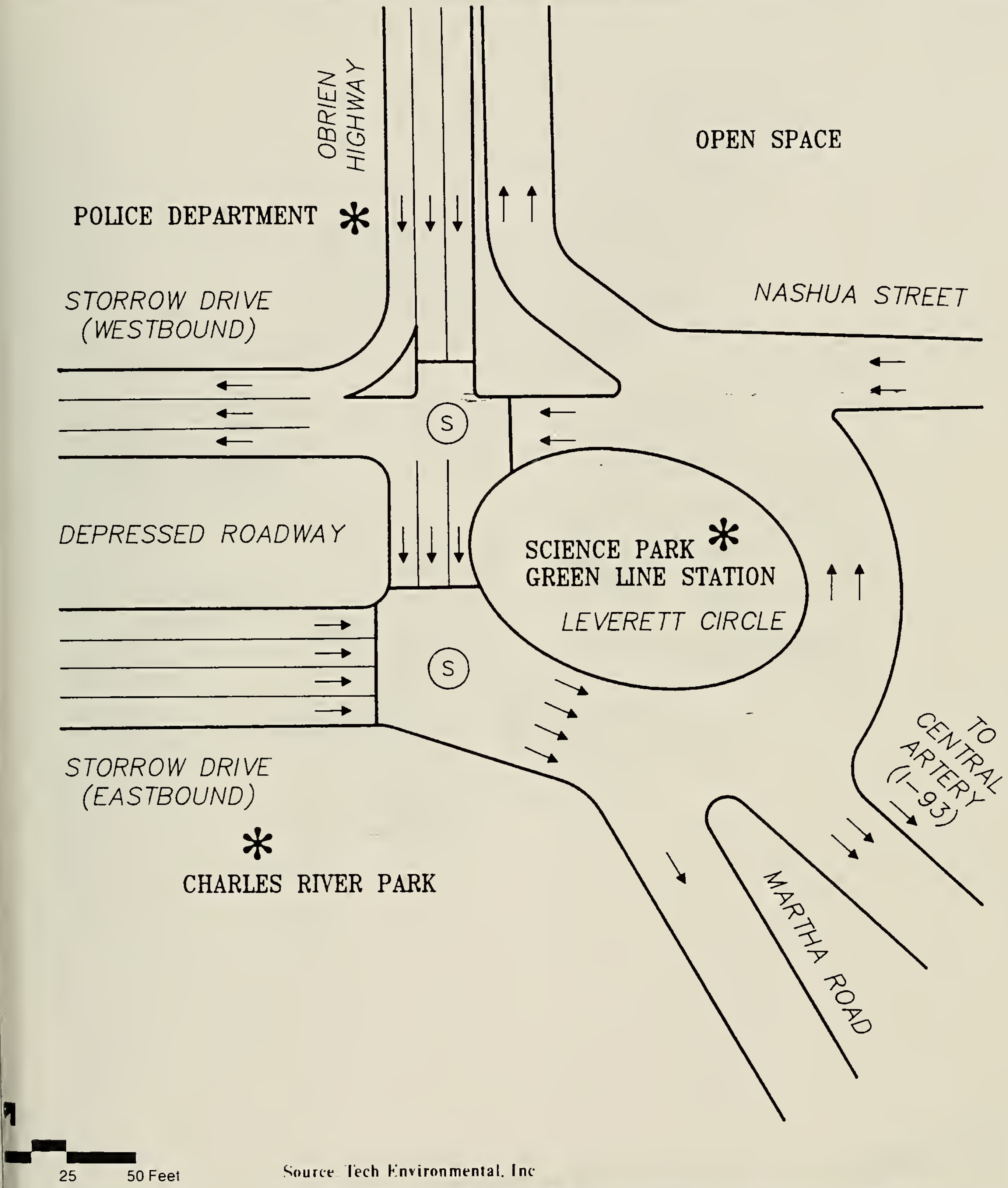
Monitoring of ambient TSP and PM10 in Boston is carried out by the DEP at four locations. The closest such monitoring station, and the one most representative of the project site, is one at 200 Columbus Avenue. The latest published data from DEP (for the year 1988) indicate the 24-hour TSP and PM10 levels measured at this monitoring station shows levels of 115 ug/m^3 (TSP) and 64 ug/m^3 (PM10). The maximum impact for construction activity is estimated to add 13 ug/m^3 to these existing ambient levels. Thus, the total levels of particulate matter will not exceed 128 ug/m^3 (TSP) and 77 ug/m^3 (PM10) during construction and will remain in compliance with the NAAQS.

Construction Mitigation Measures

The following mitigation measures will be implemented during the construction process:

- The "up-down" method of construction will minimize the time that the surface of the site is open to the elements, reducing construction dust emissions.
- A regular program of street sweeping will minimize dust from movements of construction vehicles on city streets.
- All trucks hauling demolition materials and excavate from the site will be covered.
- Fencing used around the perimeter of construction areas to shield the public will help to contain fugitive dust.
- Fugitive dust will also be controlled with water spray as needed during demolition and construction; no chemical soil stabilizers will be used.

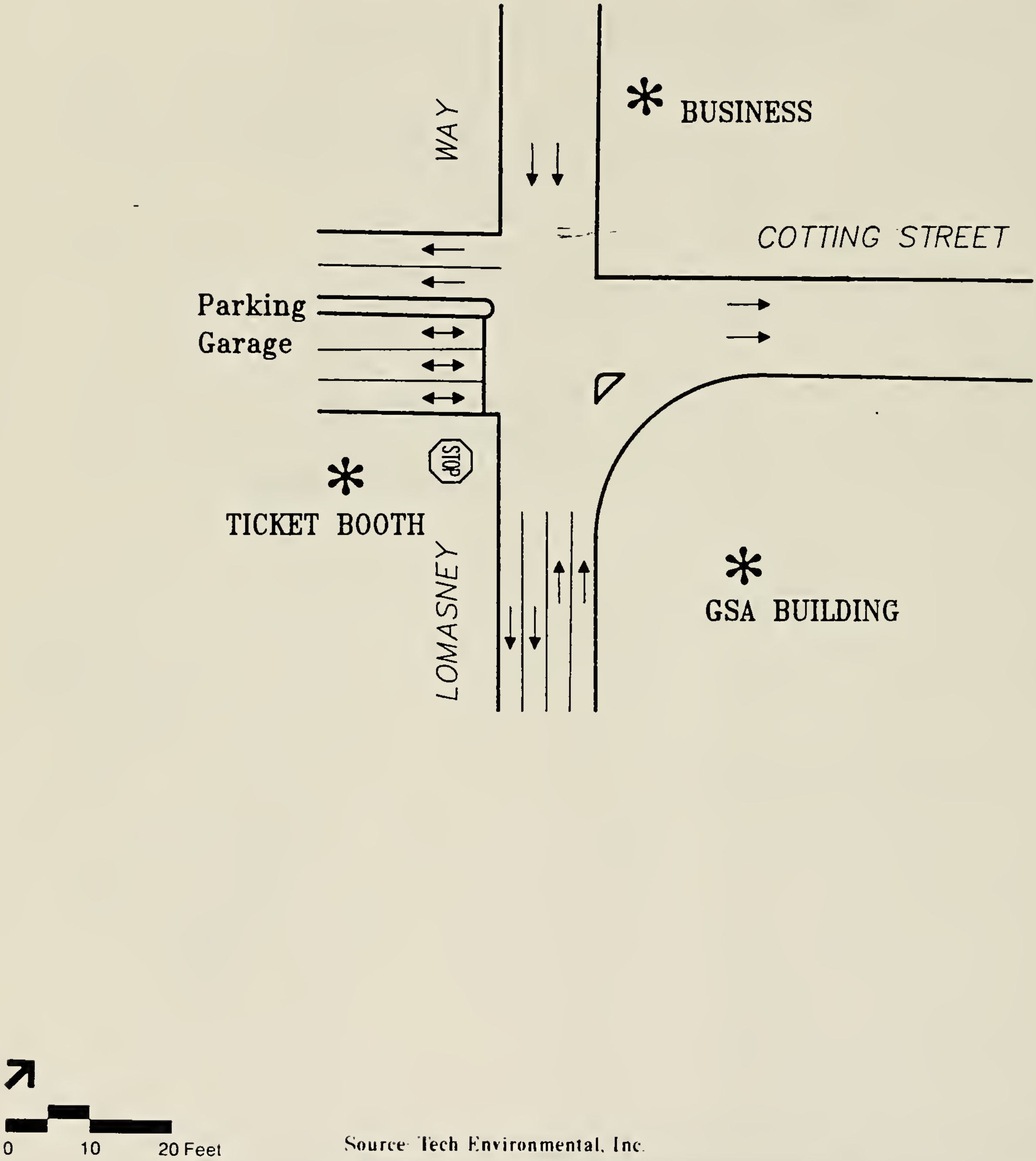
As a result of these mitigation measures, dust levels during construction will not be objectionable at sensitive receptor locations.



Source: Tech Environmental, Inc

Air Quality Receptors
Leverett Circle

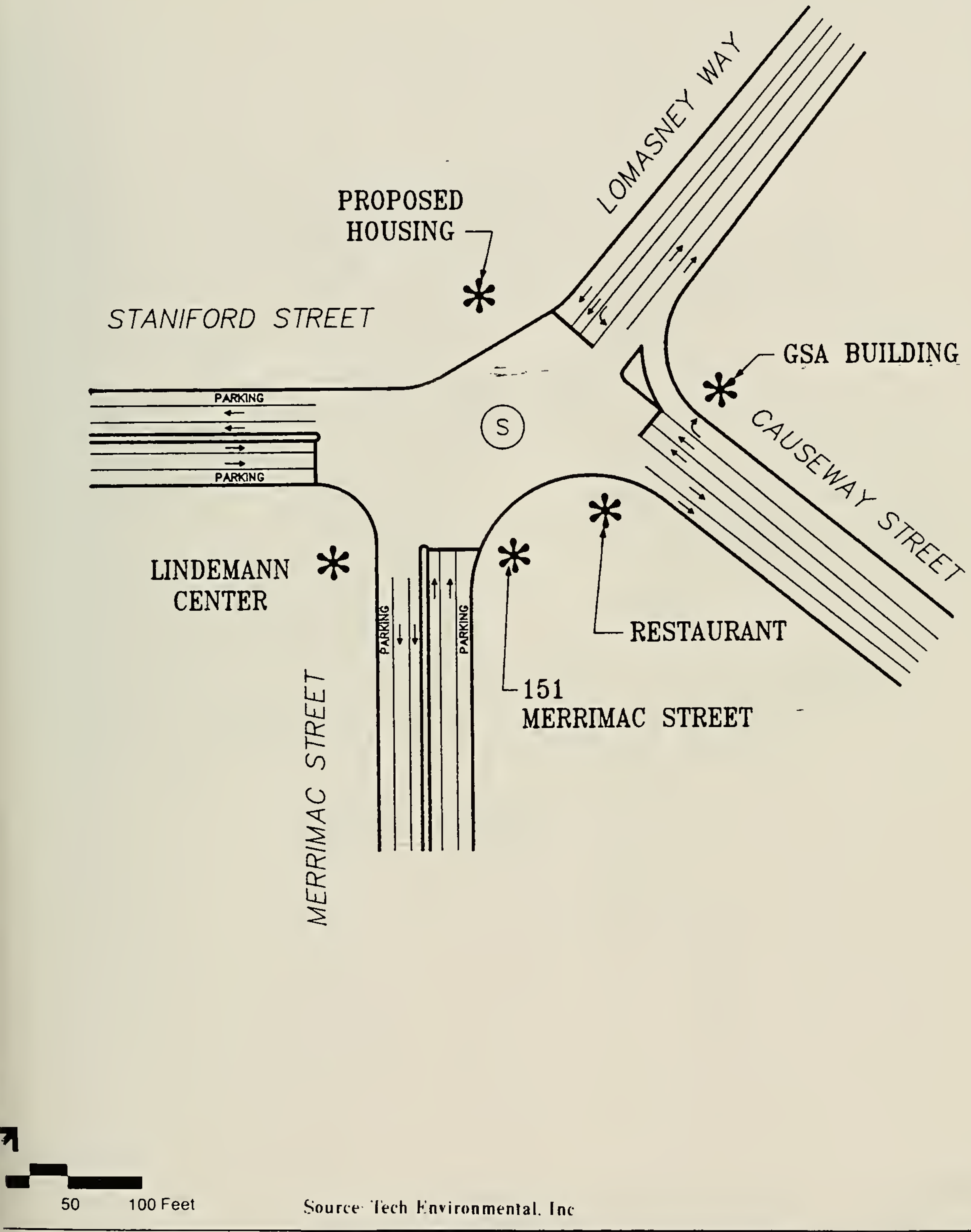
Figure IV–B–2



Source: Tech Environmental, Inc.

Air Quality Receptors
Lomasney Way/Cotting Way

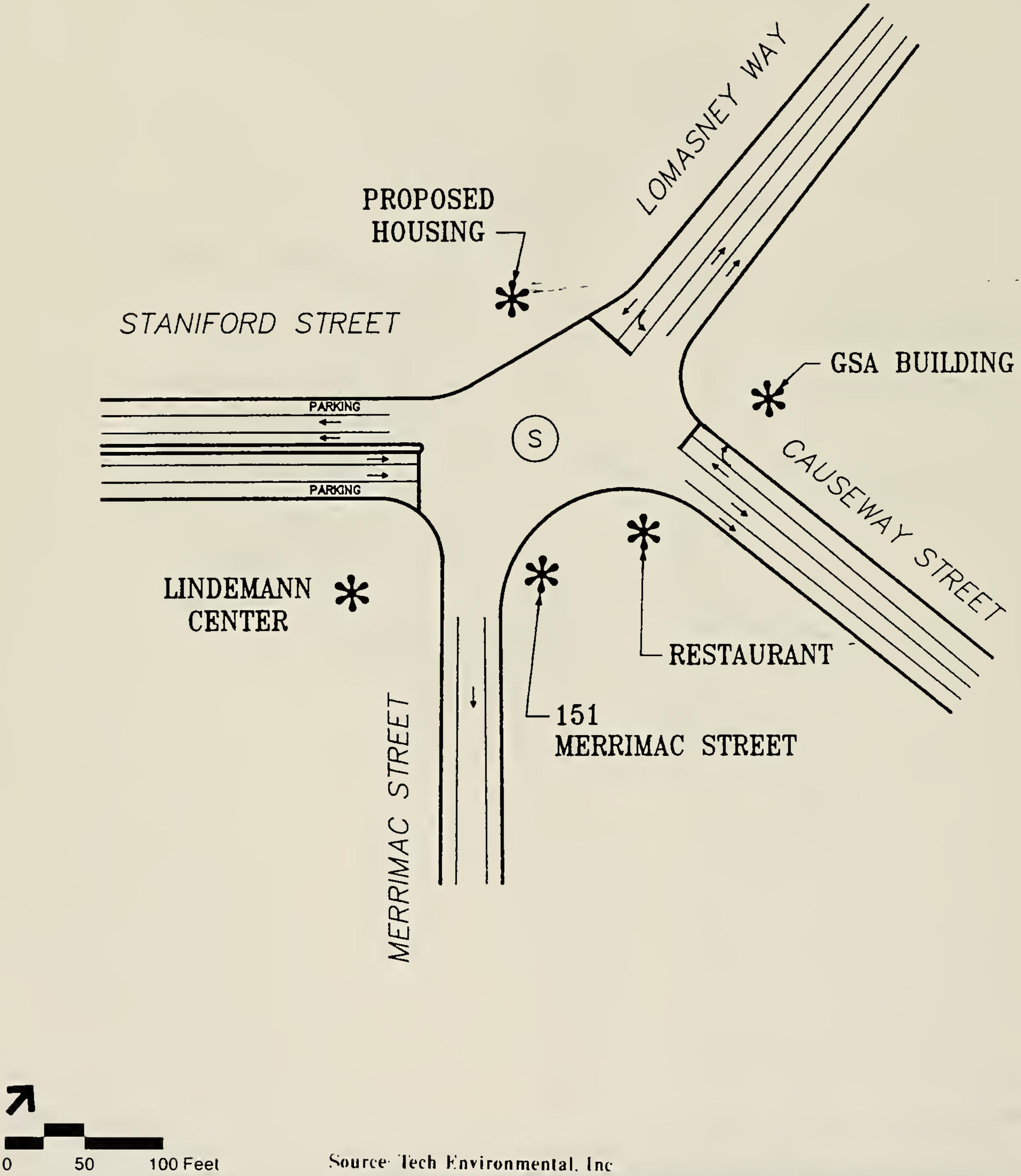
Figure IV-B-3



Source: Tech Environmental, Inc

Air Quality Receptors
Causeway Street/Lomasney Way/
Staniford Street/Merrimac Street
(1995/2000)

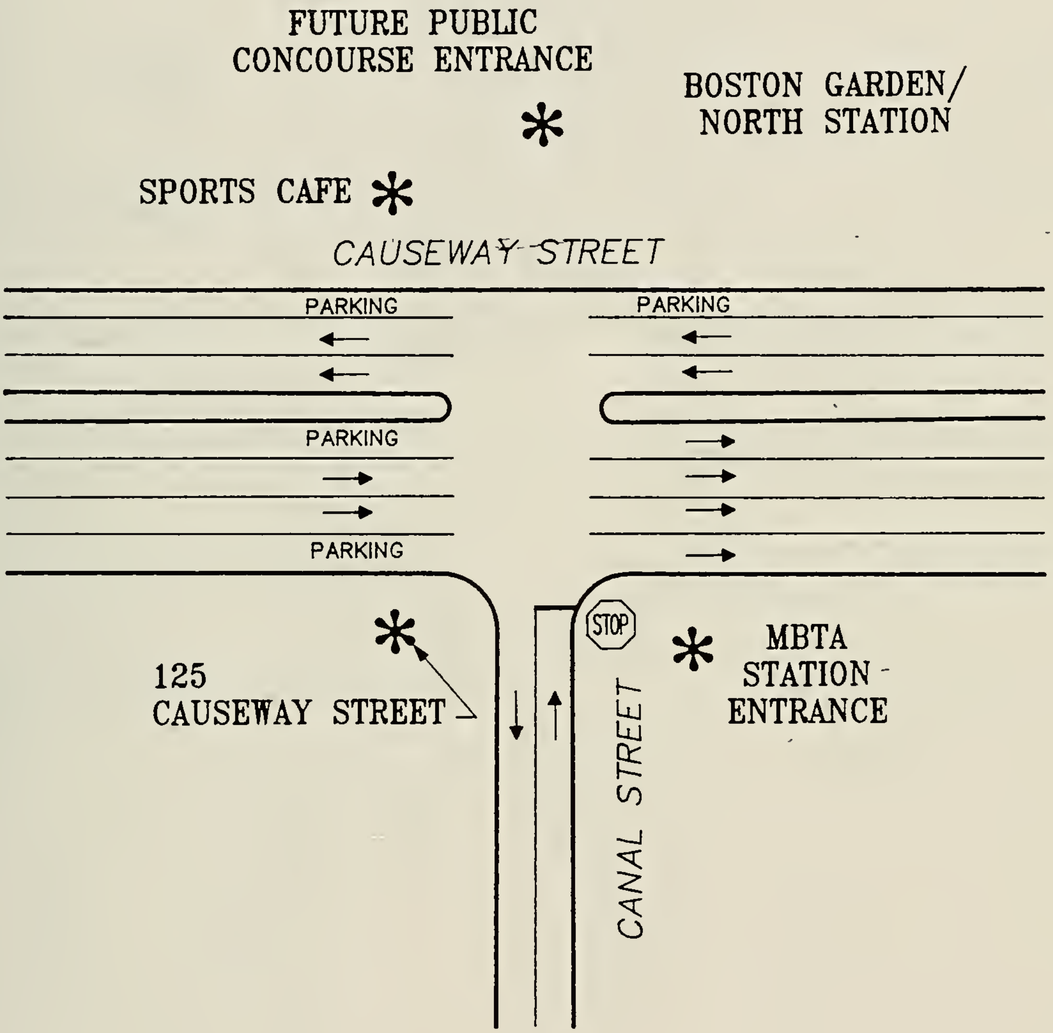
Figure IV-B-4



Source: Tech Environmental, Inc

Air Quality Receptors
Causeway Street/Lomasney Way/
Staniford Street/Merrimac Street
(1990)

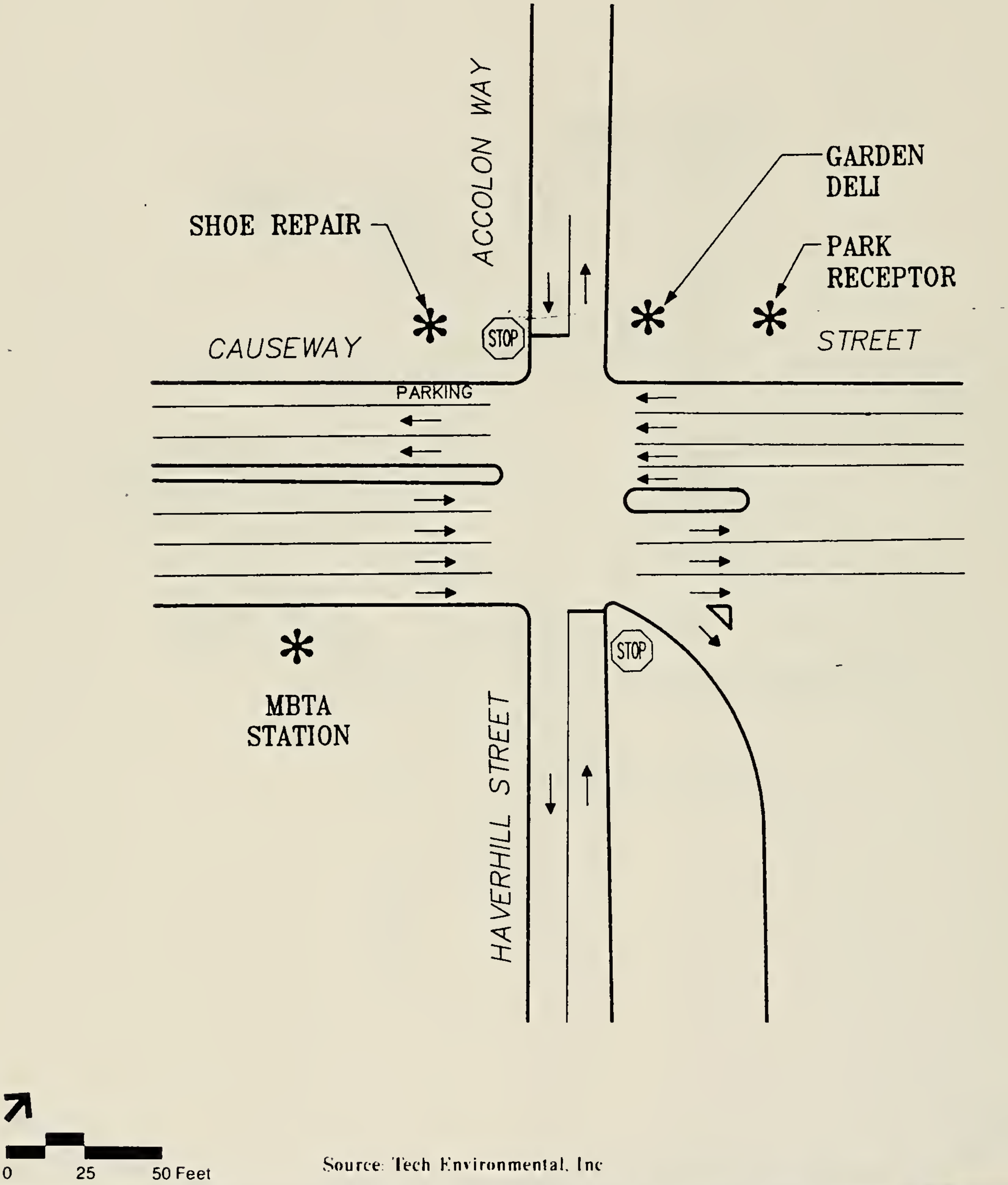
Figure IV-B-5



Source: Tech Environmental, Inc.

Air Quality Receptors
Causeway Street/Canal Street

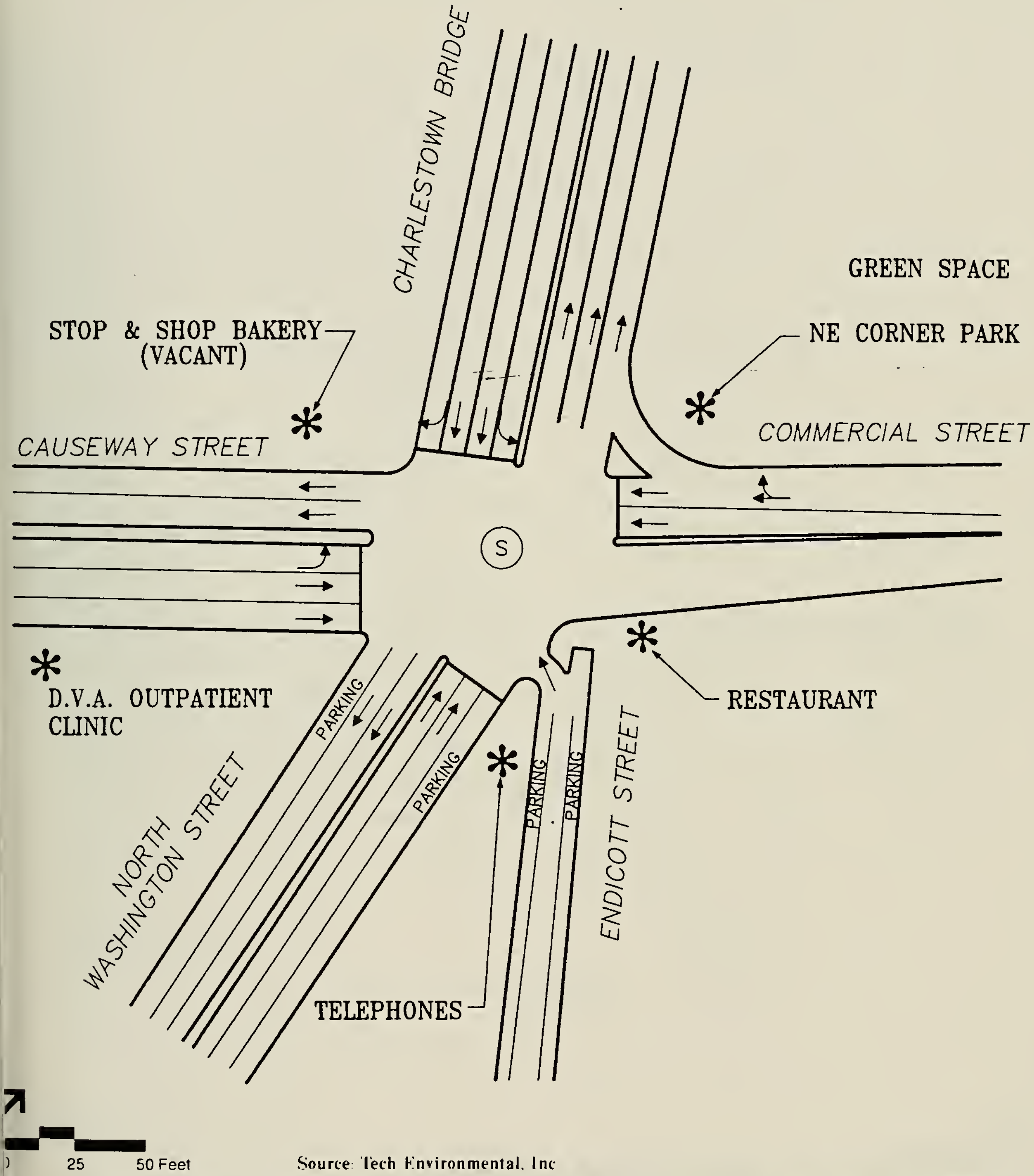
Figure IV-B-6



Source: Tech Environmental, Inc

Air Quality Receptors
Causeway Street/
Accolon Way/Haverhill Street

Figure IV-B-7

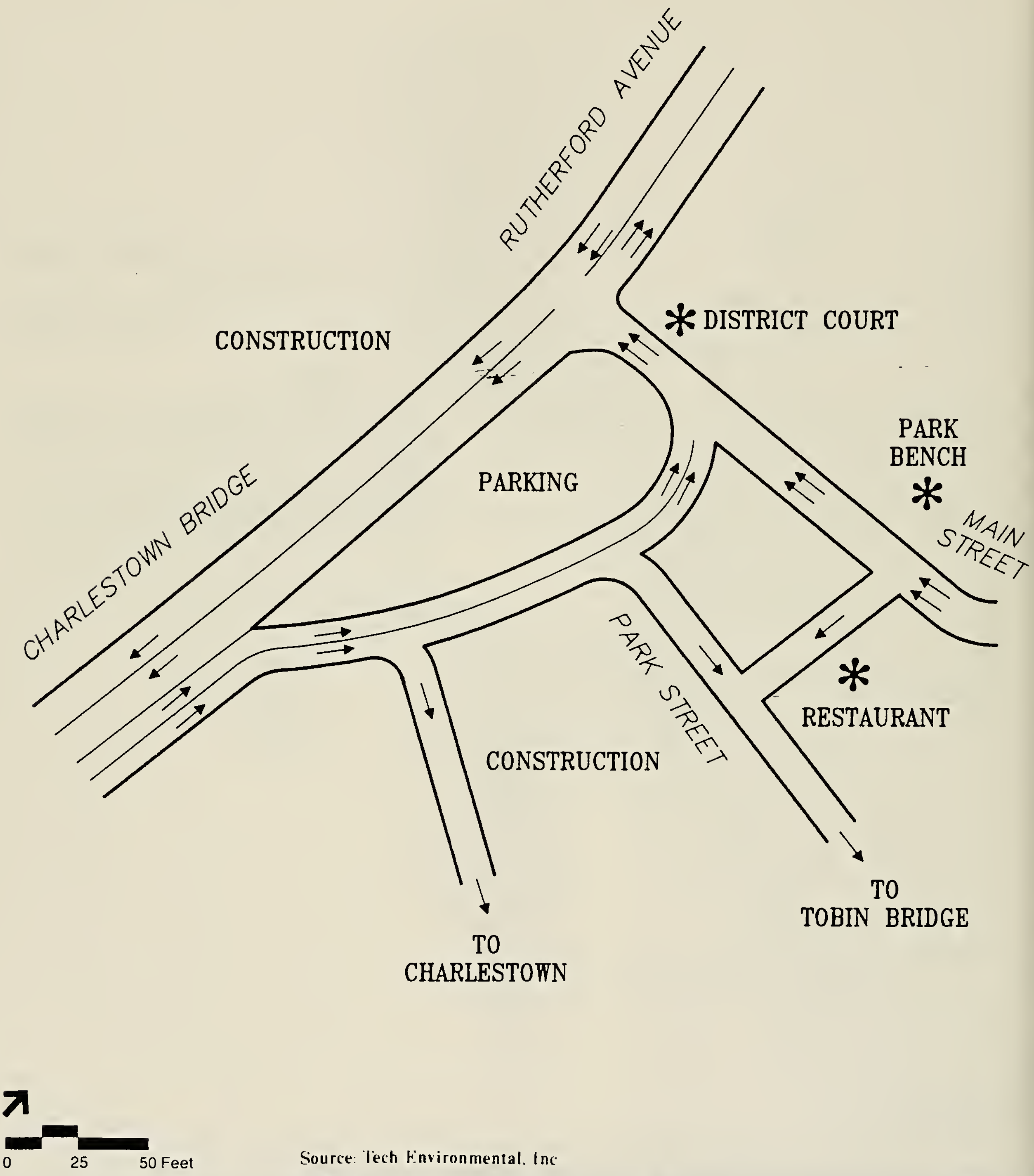


Source: Tech Environmental, Inc

Vanasse Hangen Brustlin, Inc.

Air Quality Receptors
Causeway Street/
North Washington Street/
Commercial Street

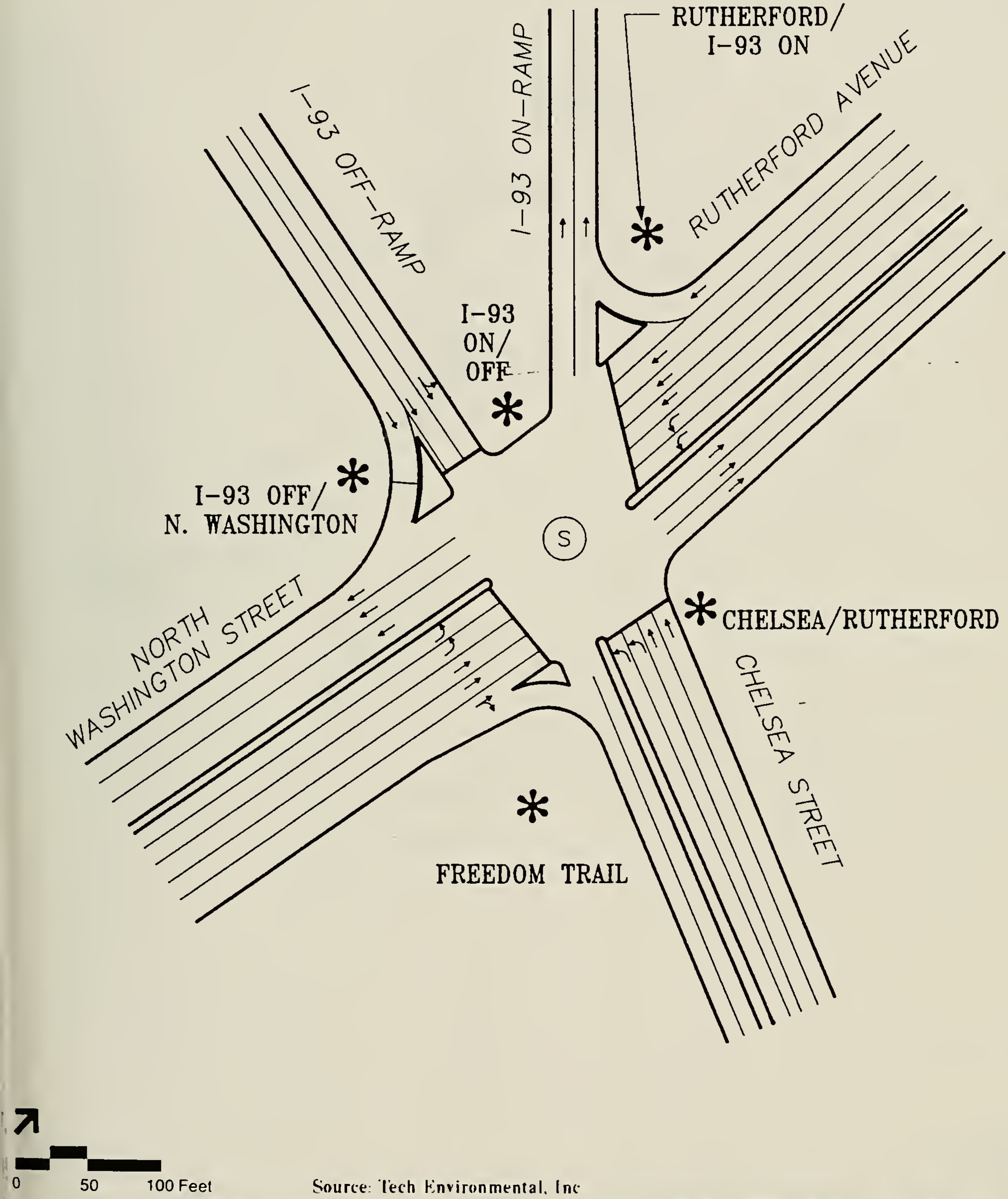
Figure IV-B-8



Source: Tech Environmental, Inc

Air Quality Receptors
City Square, Charlestown
(1990)

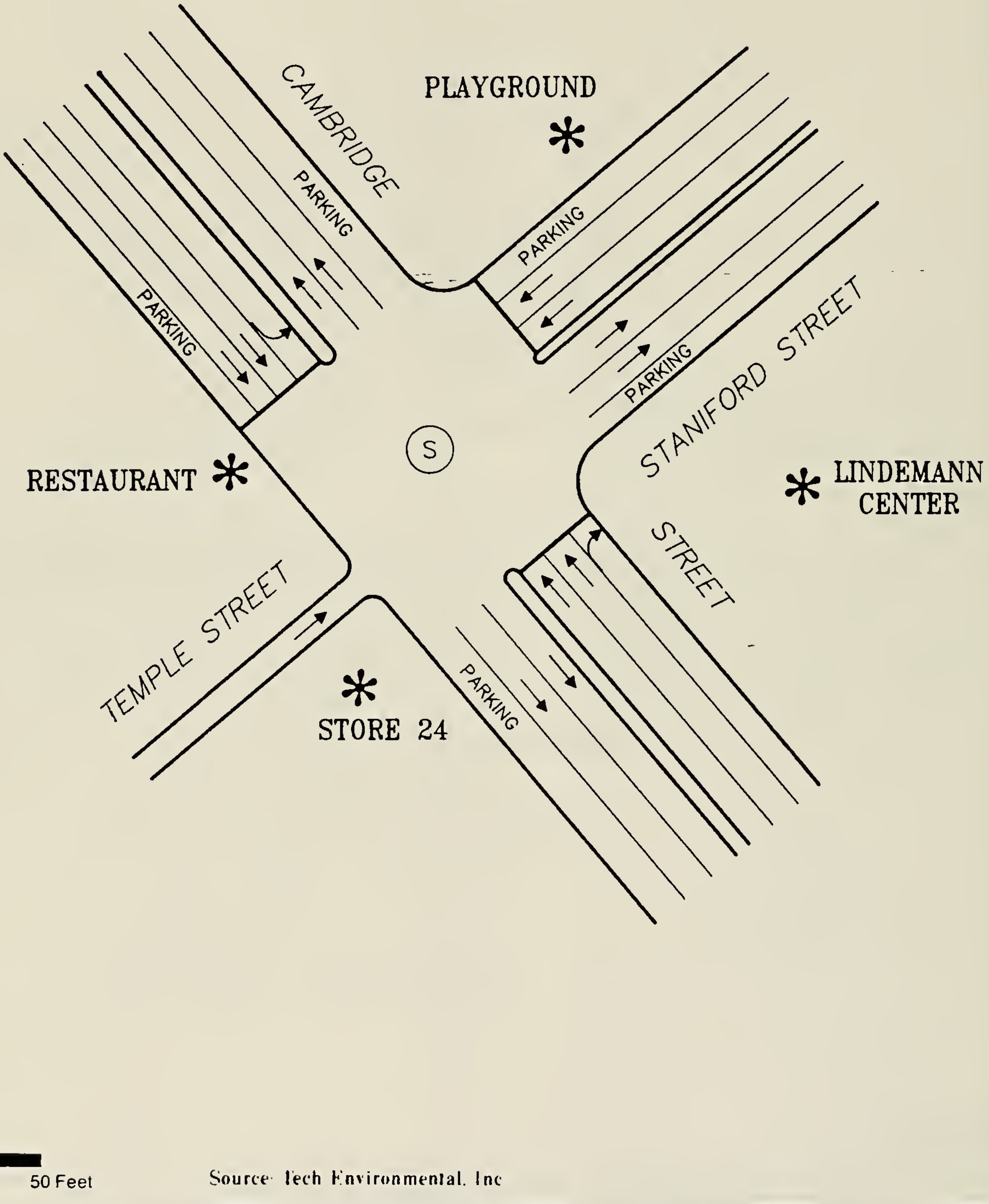
Figure IV-B-9



Source: Tech Environmental, Inc

Air Quality Receptors
City Square, Charlestown
(1995/2000)

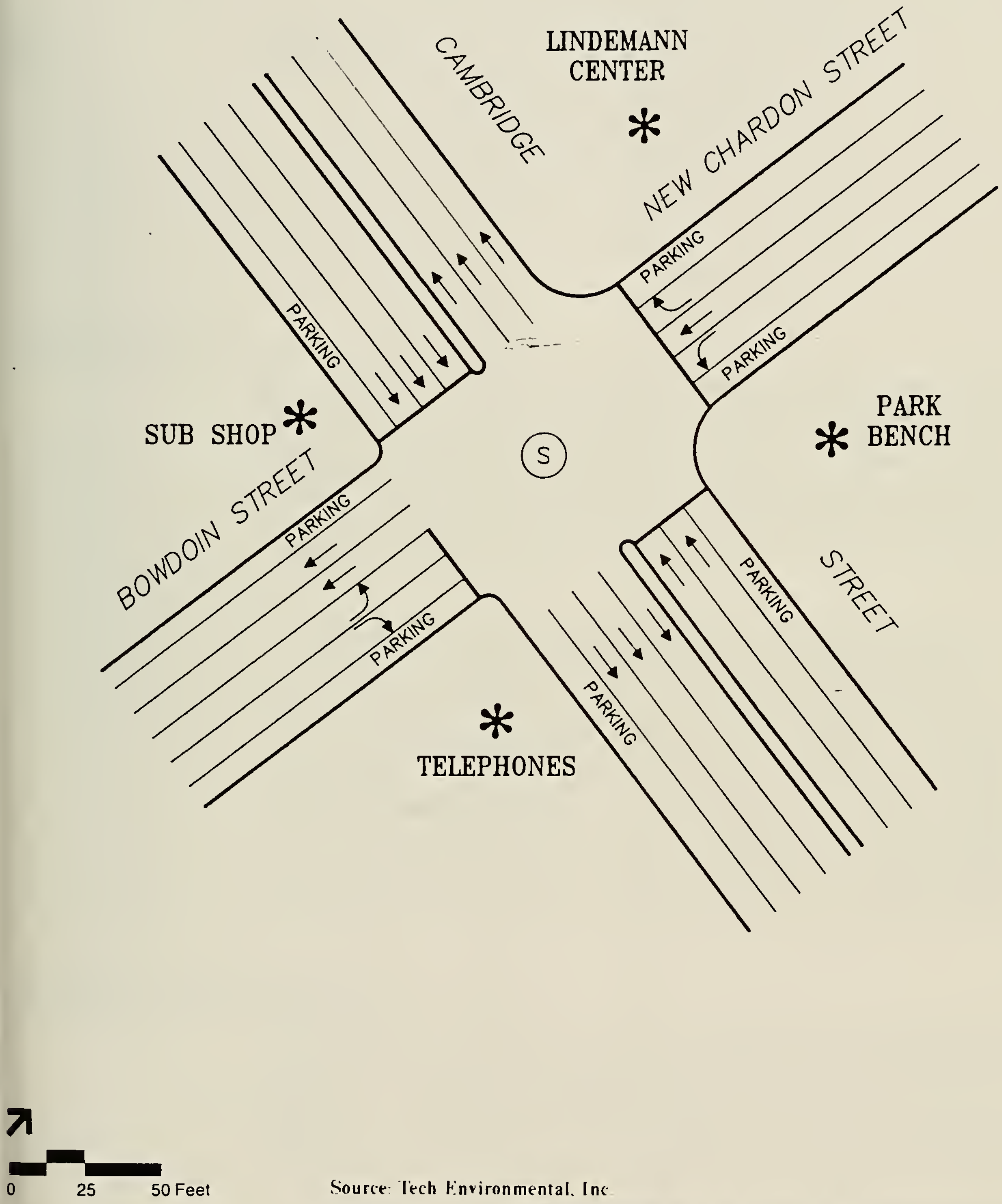
Figure IV-B-10



Source: Tech Environmental, Inc.

Air Quality Receptors
Cambridge Street/
Staniford Street/Temple Street

Figure IV-B-11



Source: Tech Environmental, Inc.

Air Quality Receptors
Cambridge Street/
New Chardon Street/Bowdion Street

Figure IV-B-12

C Noise

INTRODUCTION

The objectives of the noise analysis are to: 1) determine the long-term noise increases from project-generated traffic and from the project buildings' mechanical equipment; 2) evaluate the potential impact on nearby sensitive receptors; 3) determine if future noise levels will comply with city, state, and federal standards; and 4) describe any mitigation measures needed to avoid excessive ambient noise levels. The analysis focuses on the 1990 Existing, 2000 No-Build, and 2000 Full-Build conditions, using both ambient monitoring and computer modeling.

Both the New Boston Garden and the commercial component will fully comply with City of Boston and Massachusetts Department of Environmental Protection noise regulations for mechanical equipment. There are no federal noise regulations which apply to the project. Federal Highway Administration Noise Abatement Criteria (NAC), used for highway projects in urban areas, were adopted as an unofficial guideline for the analysis of traffic noise. None of the future peak hour noise levels exceed the NAC for indoor activities, but noise levels will exceed the NAC for outdoor activities at three of the sensitive receptor sites in both the 2000 No-Build and Build cases. None of these levels above the NAC are caused by the project, and the contribution that the New Boston Garden Development makes to these future noise levels is insignificant. For these reasons, no mitigation measures are required for project noise effects.

COMMUNITY NOISE AND REGULATIONS

The unit of sound pressure is the decibel (dB). The decibel scale is logarithmic to accommodate the wide range of sound intensities to which the human ear is subjected. Another property of the decibel scale is that the sound pressure levels of two separate sounds are not directly additive. For example, if a sound of 70 dB is added to another sound of 70 dB, the total is only a 3-decibel increase (or 73 dB). Thus, every 3 dB increase represents a doubling of sound intensity.

Non-steady noise exposure in a community is commonly expressed in terms of the A-weighted sound level (dBA); A-weighting approximates the frequency response of the human ear. Since levels of many sounds change from moment to moment, this variation must be accounted for when measuring environmental noise. One method of doing so is to determine the value of a single steady-state sound that has the same A-weighted sound energy as the time-varying sound.

This is termed the Equivalent Sound Level (Leq). The virtue of Leq is that it correlates reasonably well with the effect of noise on people, even for wide variations in sound levels and time patterns.

The noise environment of an urban community results from numerous sources. Near the project site these include motor vehicle traffic, commuter trains, aircraft over-flight, and industrial operations. Typical sound levels associated with various activities are shown in Table IV-C-1. Vehicular traffic is the primary source of ambient noise levels at most locations near the project site.

Table IV-C-1 **COMMON NOISE LEVELS**

Activity	dBA
Threshold of pain	130
Chipping on metal	120
Loud rock band	110
Jack hammer	100
Jet airlines 1/2- mile away	95
Threshold of hearing damage	90
Freeway traffic	80
Urban traffic	70
Electric typewriters	65
Normal conversation	60
Urban residential area	50
Quiet suburban area	45
Soft whisper at 5 feet	35
Wilderness area	25
Threshold of audibility	0

The Boston Air Pollution Control Commission regulates noise in the City of Boston based on land use classification. These limits apply only to mechanical equipment noise from buildings and not to project-related traffic. The regulations establish the following maximum levels for land uses:

- Industrial - 70 dBA
- Business - 65 dBA
- Residential or Institutional in an Industrial Zoning District - 65 dBA day and 55 dBA night
- Residential or Institutional - 60 dBA day and 50 dBA night

The Massachusetts Department of Environmental Protection (DEP) also regulates the noise from mechanical equipment installed on buildings but not for motor vehicle traffic. DEP requires that no single project increase noise levels more than 10 dBA above the existing background level. There are no federal noise regulations which apply to the New Boston Garden Development. For roadway noise, standards have been promulgated by the Federal Highway Administration as Noise Abatement Criteria (NAC) and these vary according to land use and activity. While the NAC are strictly applicable only to new highway projects, they provide an unofficial guideline for acceptability in other situations where motor vehicle traffic is a major noise source. The applicable activity categories for lands surrounding the project site are:

- Category B - Outdoor activities on residential and hospital properties
- Category C - Outdoor activities on other commercially developed urban properties
- Category E - Indoor activities at residential and hospital properties

The NAC for these activity categories, expressed as Leq for the peak hour are:

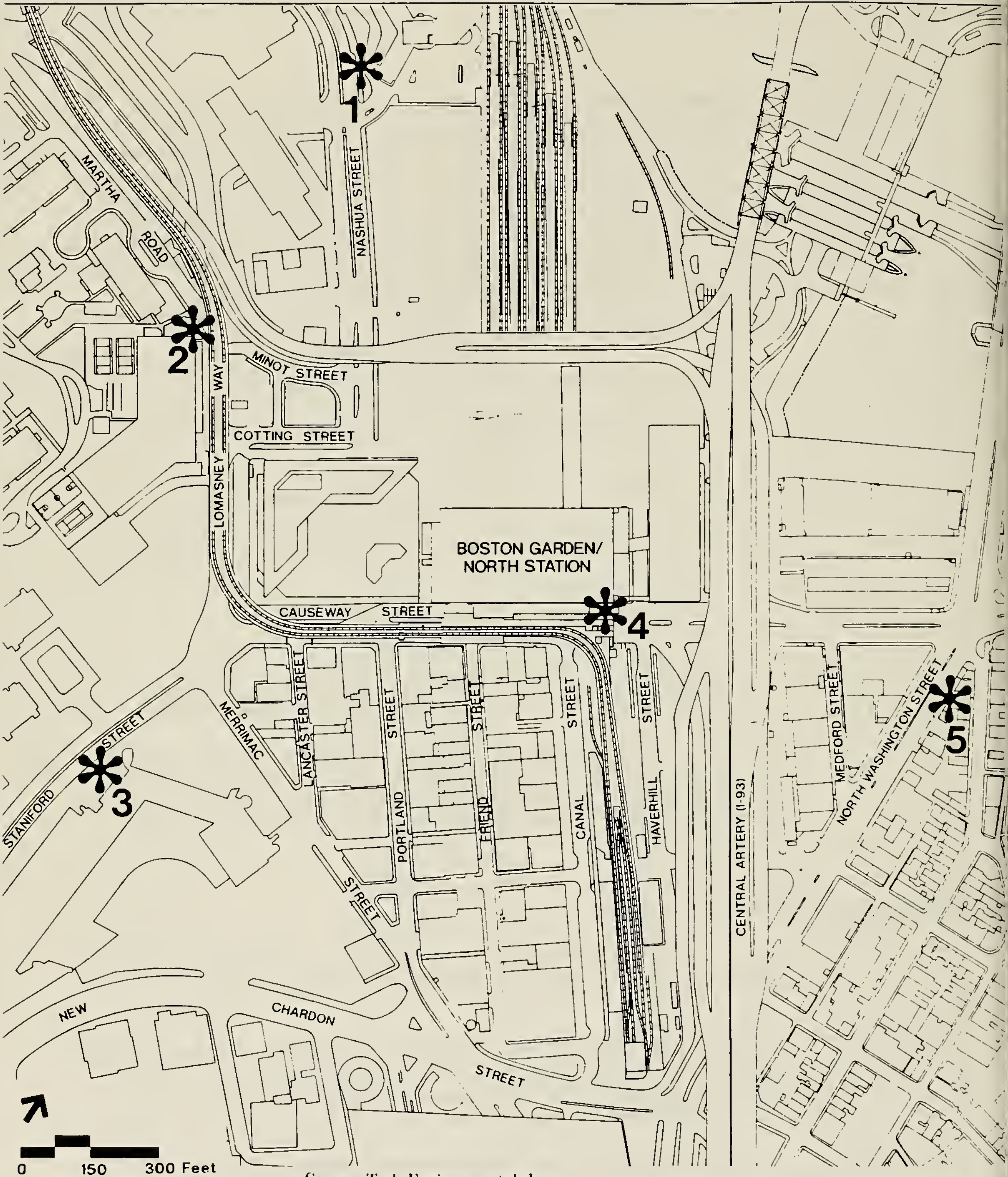
- Category B - 67 dBA outdoors
- Category C - 72 dBA outdoors
- Category E - 52 dBA indoors (equivalent to 79 dBA exterior to a New England building of average construction with the windows closed)

In this study, all predicted peak hour noise levels correspond to the outdoors. Noise levels at commercial and business properties will be compared to the Category C criteria, and levels at residential and hospital sites will be compared to Category B and E criteria to judge if noise levels are consistent with the urban land use.

EXISTING NOISE LEVELS

Five sensitive receptor locations in the project area were selected to represent a cross-section of community noise exposure. These locations, shown in Figure IV-C-1, are:

- Site 1 - On Nashua Street in front of the Spaulding Rehabilitation Hospital
- Site 2 - On Martha Road near Lomasney Way and in front of the Amy Lowell House (Charles River Park)
- Site 3 - On Staniford Street in front of the State Service Center
- Site 4 - On Causeway Street between Haverhill and Canal streets and in front of Boston Garden facing the T station entrance
- Site 5 - On 169 North Washington Street (residences) south of Causeway and Commercial streets



Source: Tech Environmental, Inc

Noise Sensitive Receptors and Monitoring Locations

Figure IV-C-1

Existing noise levels near the above receptor sites were both measured and modeled. An ambient noise monitoring program was performed on August 27, 1990, using a Quest MICRO-15 Noise Dosimeter. Values of 1-hour Leq were estimated from 15-minute measurements, and simultaneous traffic counts were recorded on nearby streets. Noise measurements, listed in Table IV-C-2, were made on sidewalks as close to the roadways as possible (usually close to the curb). Distances from the noise measurement site to the centerline of each street were recorded. Since building entrances were always located at greater distances from the street centerline, noise levels at the entrances will be slightly lower than those at the monitoring sites. The measurement site and centerline distances varied from site to site due to different roadway geometrics.

Table IV-C-2

AMBIENT NOISE MEASUREMENTS TAKEN ON AUGUST 27, 1990 NEAR SENSITIVE RECEPTOR SITES

Time	Site	Leq (dBA)
11:15 - 11:30 AM	1*	72.5
11:45 AM - 12:00 Noon	2**	72.7
12:10 - 12:25 PM	3***	70.2
2:25 - 2:40 PM	4+	82.9
3:00 - 3:15 PM	5++	73.0

* Sunny with a temperature of approximately 80 degrees F and wind from the southeast at approximately 5 to 10 miles per hour (mph). Construction noise from MBTA behind the Boston Garden. Noise from North Station locomotives reflecting off of registry building. Street cleaner passed by cars double-parked along Nashua Street; some cars were idling. Helicopter approached and landed on nearby landing pad which was approximately 400 feet from site. Artery ramp traffic heard in the distance.

** Same weather conditions as Site 1. Construction noise from work on MBTA behind Boston Garden. Light pedestrian traffic. Distant traffic noise. Noise from nearby Green Line (four trains passed during the 15-minute sampling time). Street cleaners nearby.

*** Similar weather conditions as above. Some Green Line trains and distant traffic noise audible.

+ Temperature of approximately 80 degrees F with a light breeze of approximately 5 mph. Mostly local traffic noise. I-93 ramp noise to the east. Heavy pedestrian traffic. Taxis idling in street. Green Line T station noise over Causeway Street. Ambulance with siren passed by. Automobile noise reflecting off elevated Green Line tracks.

++ Weather conditions similar to Site 4. Traffic noise from nearby intersection of North Washington, Causeway, Commercial, and Endicott streets. Light pedestrian traffic.

The ambient noise measurements in Table IV-C-2 were taken close to the roadway curb and are 2 to 5 dBA higher than noise levels at the nearest land use (the actual sensitive receptor). Accounting for this difference, all of the measurements, except the one at Site 4, are typical of noise in an urban area. At Site 4, in front of Boston Garden and under the existing elevated Green Line tracks, existing noise levels are excessively high due to the elevated train noise and the reflection of street noise from the underside of the elevated structure. This condition will change after 1995 when the elevated Green Line is removed from Causeway Street. Peak hour noise levels at the sensitive receptors currently approach or exceed the NAC for outdoor activities at Sites 1, 4, and 5. None of the existing noise levels exceed the NAC for indoor activities.

PROJECTED NOISE IMPACT FROM MECHANICAL EQUIPMENT

New Boston Garden

At this time, the New Boston Garden is expected to employ four 800-ton air-conditioning units (Baltimore Aircoil Model TI683-Q or equivalent equipment) for space cooling needs. These will be located on the roof at an elevation of 120 feet above grade at the northeast corner of the building. At the northwest corner on the same roof elevation, two cooling towers for the ice rink will be located (Baltimore Aircoil Model F1661-0 or equivalent equipment). Sound rating data sheets from the manufacturer list the following sound pressure levels at a reference distance of 50 feet:

Model	Air Inlet (dBA)	Unit End (dBA)
TI683-Q	68	61
F1661-0	69	62

Using these data and presuming the cooling units will act as a point source of noise from distant sensitive receptors, sound levels were predicted at the five noise receptors assuming all six units are operating simultaneously. These predicted levels are given in Table IV-C-3 and are all in compliance with City of Boston limits. Since existing background levels of noise are higher than the predicted contribution from New Boston Garden mechanical equipment, it can be concluded that the New Boston Garden will comply with DEP's noise regulation.

Commercial Component

The commercial component is still at the concept plan level of design. For purposes of this impact assessment, it has been assumed that the commercial component of the project is expected to require three 800-ton air conditioning units (Baltimore Aircoil Model TI683-Q or equivalent equipment) to be mounted on each of the roofs of Buildings A, B, and C. The sound rating information for this cooling unit is given in the previous section. Predicted noise levels from these nine cooling units, in addition to those from the New Boston Garden, are given in Table IV-C-4. Due to the height of the buildings, there will not be a direct line of sight from the rooftop units to the ground level receptors analyzed in this study. For that reason, the rooftop units on Buildings A, B, and C add only a small amount of noise to the total generated by the New Boston Garden Development. In one instance, at the receptor in front of the Amy Lowell House (Charles River Park), the combined noise level actually decreases because the bulk of Building A will block any line of sight from this receptor to the ice rink cooling towers. The maximum noise levels in Table IV-C-4 are all in compliance with City of Boston limits. Since existing background levels of noise are higher than the predicted contribution from the mechanical equipment for the Full-Build condition, it can be concluded that the project will comply with DEP's noise regulation.

Table IV-C-3 **NOISE LEVELS FROM MECHANICAL EQUIPMENT FOR THE NEW BOSTON GARDEN AT SENSITIVE RECEPTORS**

Receptor	Maximum Noise Level (dBA)	City of Boston Limits Day/Night (dBA)
1. Spaulding Rehabilitation Hospital	43.7	65/55
2. Amy Lowell House	49.7	60/50
3. State Service Center	46.7	65/65
4. Boston Garden Entrance	49.9	65/65
5. Residences on North Washington Street	48.7	65/55

Table IV-C-4 **NOISE LEVELS FROM MECHANICAL EQUIPMENT FOR THE FULL-BUILD CONDITION AT SENSITIVE RECEPTORS**

Receptor	Maximum Noise Level (dBA)	City of Boston Limits Day/Night (dBA)
1. Spaulding Rehabilitation Hospital	44.9	65/55
2. Amy Lowell House	44.7	60/50
3. State Service Center	47.4	65/65
4. Boston Garden Entrance	51.0	65/65
5. Residences on North Washington Street	49.1	65/55

Model Validation

The traffic counts taken during the noise measurements were input to the FHWA Highway Traffic Noise Prediction Model[1] to validate the model for the project site. The model worksheets are included in the Technical Data appendix, and the results are summarized in Table IV-C-5. The model underestimates Leq noise levels at all five sites. Differences between measured values and modeled values are shown in the fourth column of Table IV-C-5. The difference between measured and modeled noise levels for each site is likely due to a number of events which the FHWA model does not take into account. Such events for Site 1 include North Station locomotive and construction noise reflecting off of the registry building (very audible), a helicopter approaching and landing nearby, and double-parked and idling automobiles close to the monitoring site. These events are believed to be responsible for the 6.0 dBA difference in noise levels.

Table IV-C-5 **COMPARISON OF MEASURED AND MODELED NOISE LEVELS (1-HOUR LEQ IN dBA)**

Site No.	Measured* 1990 Existing	Modeled* 1990 Existing	(Measured - Modeled)
1	72.5	66.5	6.0
2	72.7	70.3	2.4
3	70.2	70.1	0.1
4	82.9	65.9	17.0
5	73.0	70.7	2.3

* At a near curb location.

Site 2 has a difference of 2.4 dBA between measured and modeled noise levels.. This may be the result of a combination of the nearby passing MBTA Green Line trains, the MBTA construction noise behind Boston Garden, and the other items identified in the notes on conditions during readings.

Site 3 exhibits a measured/monitored difference of only 0.1 dBA. Differences less than 1 dBA are not considered significant. Since no significant extraneous noise sources existed near Site 3, the comparison indicates the model does an excellent job of predicting the vehicle traffic component of noise.

The relatively large difference (17.0 dBA) at Site 4 can be explained by the reflection of traffic noise by the elevated MBTA Green Line, noise produced by the Green Line trains, and noise from the elevated portion of I-93 where it crosses Causeway Street.

1/ FHWA Highway Traffic Noise Prediction Model, FHWA-RD-77-108; Federal Highway Administration; Washington, DC (December 1978).

The underestimation by the model (2.3 dBA) for Site 5 is most likely due to the exclusion from the model of a significant number of large diesel trucks and automobiles at the nearby intersection of North Washington, Causeway, Commercial, and Endicott streets. These vehicles turned at the intersection and did not pass in front of the monitoring site. The model used only vehicle counts on North Washington Street south of the intersection.

A background noise level for extraneous sources was incorporated in modeling of future noise levels except at Sites 3 and 4. Noise level differences of 3.0 dBA and less are generally not perceptible. Thus, Site 3 need not be modified from its modeled value. At Site 4, the extraneous noise due to the MBTA Green Line trains and elevated I-93 will not be present in the year 2000, so no modification is required. At Site 1, some of the 6.0 dBA difference was due to a helicopter landing nearby. To verify the background level for this site, a second set of measurements was taken on September 11, 1990, from 3:00 PM to 4:00 PM at the side of the Spaulding Rehabilitation Hospital facing Nashua Street. During that hour, the measured noise level was 68.2 dBA and the corresponding model prediction is 63.3 dBA, for a background difference of 4.9 dBA. A total of eight helicopters passed over or landed at the Boston helipad owned by the Massachusetts Aeronautics Commission during that hour. This confirmed that helicopter noise is common at the hospital. This commercial helicopter traffic is unrelated to operations at Spaulding Rehabilitation Hospital. Since the helipad will remain at its current location in the future, the helicopter noise is retained in the background noise component. By adding in background levels at Sites 1, 2, and 5 to modeled predictions of traffic noise in the year 2000, a more accurate estimate of actual future outdoor noise levels is obtained.

Modeling Results

Peak hour traffic volumes for the 2000 No-Build and 2000 Full-Build conditions were input to the FHWA noise model to predict peak hour noise levels at the five sensitive receptors. At Sites 1, 2, and 5, background levels of 4.9, 2.4, and 2.3 dBA, respectively, were added in as discussed in the previous section. The model predictions were made at the closest land use to the road in each case. For example, at the Spaulding Hospital, the portion of the building closest to the reconstructed Nashua Street determined the exact receptor location. To provide a comparison with existing conditions, the traffic volumes measured during the model validation study were used to generate 1990 Existing noise levels at the same locations. The results are given in Table IV-C-6.

Predicted peak hour noise levels in Table IV-C-6 exceed the NAC for outdoor activities at Sites 1, 2, and 5 in both the 2000 No-Build and Build cases. None of the future noise levels exceed the NAC for indoor activities. None of the future peak hour noise levels above the NAC for outdoor activities are cased by the project. The New Boston Garden Development will add from 0.0 to 1.4 dBA to peak hour noise levels in 2000. Since increases of less than 3 dBA are generally not perceptible, the small increases in noise levels from project traffic are deemed insignificant. For this reason, no mitigation measures are required for project traffic noise effects.

Table IV-C-6 **MAXIMUM 1-HOUR LEQ NOISE LEVELS IN 2000 AT SENSITIVE RECEPTORS (dBA)**

Site No.	1990 Existing*	2000 No-Build*	2000 Full-Build*	Increase Due To Project
1	67.0	70.6	72.0	1.4
2	65.7	68.7	69.4	0.7
3	65.9	66.9	67.1	0.2
4	79.8	66.3	66.3	0.0
5	71.3	70.3	71.2	0.9

* At the closest land use to the road.

MITIGATION MEASURES FOR OPERATIONAL NOISE

Both the New Boston Garden and the commercial component will fully comply with City of Boston and Massachusetts Department of Environmental Protection noise regulations for mechanical equipment. The analysis of noise from all sources shows that none of the future peak hour noise levels will exceed the NAC for indoor activities, but that noise levels will exceed the NAC for outdoor activities at three of the sensitive receptor sites in both the 2000 No-Build and Build cases. None of these levels above the NAC are caused by the project, and the contribution that the New Boston Garden Development makes to these future noise levels is insignificant. For these reasons, no mitigation measures are required for project noise effects.

CONSTRUCTION NOISE IMPACTS AND MITIGATION MEASURES

Construction-related noise impacts will occur during construction of both the New Boston Garden and the commercial component. The principal noise-generating activities include: demolition of the existing Boston Garden; excavation for the project Garage and foundation construction; steel erection and building cladding; diesel truck traffic moving to and from the site; and construction vehicles operating on site.

Demolition of the existing Boston Garden will be accomplished using standard mechanical techniques. Since explosives will not be used in the process, the noise impacts of demolition are expected to be minimal and will occur over a ten-month period starting in June 1993. Noise impacts from construction machinery operating on site will be unavoidable, temporary, and variable in nature. The noise on any given day will depend on such factors as what areas are being worked, the distance to nearby sensitive receptors, and the type and quantity of equipment in use. Excavation for the project Garage and foundation construction will occur over a nine-month period starting in April 1994. Steel erection and building cladding for the New Boston Garden and the elements of the commercial component will occur off and on during the ten-year construction period starting in mid-1991.

The greatest noise impact will likely occur from trucks visiting the site to remove excavate and demolition debris and to deliver materials. It is expected that during the peak period, approximately 100 truck loads per day will need to be hauled from the site. Truck volumes associated with other aspects of project construction have not yet been determined. However, it is anticipated that for the remainder of the construction period, truck traffic is likely to be less than one-quarter of the level generated by excavation activities. These impacts will be temporary, will decrease substantially after excavation for the project Garage is complete at the end of 1994. In order to mitigate the short-term impacts of the truck traffic, specific truck routes will be specified by the Boston Transportation Department through the Construction Management Plan.

As required by DEP Air Pollution Control Regulation 7.10, measures will be taken to minimize noise impact on the surrounding community. The City of Boston's noise regulations for construction activity state the maximum noise level that may be exceeded 10 percent of the time (L10) in a business area such as the one abutting the project site is 80 A-weighted decibels (dBA). This limit applies at the property boundary but no closer than 50 feet to the construction site. The City's regulation excludes the noise from "impact devices", namely paving-breakers, power hammers, wrenches, riveters, and stud-drivers. If requested by the City of Boston Air Pollution Control Commission, the proponent will take noise measurements during construction to demonstrate compliance with the City's regulation for construction noise. In addition, the following noise mitigation measures will be implemented:

- No pile-driving will be done on the site. Foundation work is to be slurry walls and caissons.

- No explosives will be used for demolition.

- All noise-generating equipment to be used will be inspected to ensure a noise muffler is in place and in good working condition.

- Safety fencing placed on the perimeter of the site will help to shield the community from noise. In addition, excavation is below-grade and is shielded by concrete slabs, as part of the "up-down" construction method.

As a result of the implementation of mitigation techniques, construction noise from the project will comply with DEP and City of Boston regulations.

D Visual Quality

INTRODUCTION

This chapter addresses a range of visual quality and urban design issues which are associated with the New Boston Garden Development. Potential project-related effects of the 2000 Full-Build conditions are assessed using computer-generated project views from nine representative, publicly-accessible vantage points surrounding the site. In addition, elevation and section studies of area and project buildings along Canal Street, Causeway Street, Nashua Street, and the Central Artery are presented in order to: 1) illustrate the relationship of the height and mass of nearby buildings to the Full-Build project and, 2) illustrate the internal relationships of the buildings within the complex.

These studies are analyzed in terms of the urban design and aesthetic qualities embodied by the various types of development which presently exist in the site vicinity. Development existing within the project area comprises a wide variety of styles and urban scale, ranging from mid-rise nineteenth century buildings along narrow, commercial streets to modern high-rise buildings within open monumental sites. This analysis has been conducted based on the following premises:

- Development of the project site should respond sympathetically to the varying urban design contexts
- The location and character of the project site, the scale of historic uses, and the role of current and proposed future uses in the city necessitate a strong architectural and urban design treatment

Many of the Figures that support this analysis are presented in Chapter II, Project Description and Chapter III, Site and Area Description.

URBAN DESIGN CONTEXT

Project Site

The proposed project site totals approximately 6.7 acres in the North Station area of Boston. The New Boston Garden Development site will be bounded by Causeway Street to the south, the future mainline of the reconstructed Central Artery (I-93) to the east (which will necessitate demolition of the Anelex Building), the Central Artery ramps connecting to Leverett Circle and Storrow

Drive to the north, and Nashua Street and a pedestrian way adjacent to the GSA Building to the west. The existing Boston Garden/North Station is the only major existing structure on the proposed site. Other areas are occupied by roadways, parking areas, are vacant, or are under construction. Additional information on the project site is provided in Chapter III, Site and Area Description. The history of the site is provided in brief in Chapter III and in somewhat more detail in Chapter IV-E, Historic Resources. In summary, since the early to mid-1800s, the North Station area has been the site of large-scale train stations and other major structures. This pattern is continued today with the presence of the existing Boston Garden/North Station, the GSA Building, the Anelex Building, the Hoffman and Stop & Shop buildings, and the Spaulding Rehabilitation Hospital. All of these structures are of a larger base area and greater height than buildings south of Causeway Street.

Surrounding Context

The North Station area is located near the Charles River at the northern edge of downtown Boston (the Shawmut Peninsula). The area is bounded by several districts, representing an extraordinary diversity of urban design patterns and architectural styles. Each of these districts is described in Chapter III, Site and Area Description and is summarized below:

- Bulfinch Triangle - An historic area of five- and six-floor nineteenth century commercial masonry buildings currently occupied by office, retail, and restaurant uses. The district is characterized by long narrow blocks, narrow streets, and sidewalks with a consistent streetwall, except in places where parcels are vacant. Various nineteenth century commercial architectural styles are represented in the Bulfinch Triangle. The northwest-southeast streets are parallel to each other, terminating (to the north) at a slight angle from perpendicular to Causeway Street. The Central Artery cuts the eastern one-third of the district from the rest of the area. Parking is located on-street or in small vacant lots.

- West End - An area whose identity is now defined by Boston's urban renewal efforts of the 1960s and 1970s. The West End is characterized by two large complexes--Charles River Park and Massachusetts General Hospital (MGH)--and other large-scale governmental, institutional, and commercial uses. Numerous high-rise structures (up to 400 feet in height) are present, sited on open plazas (Charles River Park) or in a campus-type arrangement (MGH). The Registry of Motor Vehicles and Boston Thermal define the eastern edge of the district. With the exception of the Registry and Boston Thermal buildings, buildings are designed in a range of "modern" architectural styles. Building and facade materials include concrete, glazed brick and other masonry, metal panels, and glass. Parking is in large, multi-level structures above-grade or underground. The area's streets are wide, curving, divided boulevards. For an area this large, relatively few streets provide access through it.

- Government Center - An area of extensive urban renewal efforts in the 1960s. Government Center is an area of large-scale federal, state, municipal, institutional, and office buildings with large open plazas. High-rise and mid-rise structures are interspersed. The buildings are dramatic examples of the range of 1960s modern architectural expression. The principal building material is concrete or light-colored pre-cast panels, and the primary pavers are brick and concrete. Parking is located in very large structures above-grade or beneath buildings. The area's streets are wide, curving, divided boulevards. The Lindemann Mental Health Center (State Service Center) and the Government Center garage are closest to the project site, and they define the western edge and southern apex, respectively, of the Bulfinch Triangle.

- North End - A unique residential district of three- to six-floor, nineteenth and twentieth century brick buildings. The district is characterized by small, irregularly shaped blocks, narrow streets, and narrow sidewalks with a consistent street wall. Parking is primarily on-street. Institutional uses (churches, schools, libraries, etc.) are interspersed within the area, as are small parks and open spaces. Retail uses occupy the first floor of many buildings, especially on Hanover and Salem streets. Revolutionary-era sites and the wharves on the North End waterfront reflect elements of the area's historic past. Large-scale nineteenth century brick commercial structures are located on North Washington Street and on Commercial Street and Atlantic Avenue.

PLANNING CONTEXT

For more than two decades, Boston has planned for the creation of a new or rehabilitated sports and entertainment arena to serve the City's needs. This process culminated in the selection by the Boston Redevelopment Authority in 1988 of New Boston Garden Corporation's development proposal and the adoption of Article 39 of the Boston Zoning Code in 1989. The City's planning process and Article 39 (North Station Economic Development Area (EDA)) are described in Chapter II, Project Description. The goals of the North Station EDA are to:

- Create a northern gateway to the city by public transportation and by automobile;
- Direct downtown development in a way that promotes balanced growth for Boston and channels growth away from the congested center;
- Create a mixed-use district which, among other uses, includes office, retail, and sporting and entertainment uses;
- Create a mix of facilities which will foster economic growth in Boston and throughout the region; and
- Create a functionally and architecturally unified district which is compatible with the North End and the Bulfinch Triangle.

Within the North Station EDA, buildings are allowed an as-of-right height of 400 feet and an as-of-right floor area ratio (FAR) of 11. In addition, Article 39 sets forth the following provisions:

- Continuity of the existing street wall
- A street wall height limit of 125 feet

- Building setbacks of 40 feet in depth above the street wall base on Causeway Street (setback may be averaged for two or more buildings) and a setback depth of 35 feet on Nashua Street

- Portions of projects greater than 175 feet in height should create a visually distinctive roof or other termination of the facade

PROJECT DESIGN

The New Boston Garden Development is comprised of a modern sports and entertainment arena, a Public Concourse, and a commercial component consisting of three office buildings with active retail bases and an underground garage. The project also includes various site amenities such as open pedestrian walkways and a covered pedestrian arcade on Causeway Street. The FAR of the project is 10.6. The project is presented in detail in Chapter II, Project Description.

In terms of urban design, the project is an ensemble of four buildings of varying heights, linked by base elements but sufficiently distinct in massing to avoid the appearance of a "superblock." Buildings B and C and the arena cluster around the Public Concourse, which serves as a portal to the complex. The Public Concourse is the lowest element in height on Causeway Street and it is inset from the street wall established by the bases of Buildings B and C. These base elements are approximately 100 feet high, relating to other structures on the north side of Causeway Street and to the Bulfinch Triangle on the south side of Causeway Street. Set back from the Causeway Street arcaded facade (which includes an active retail base) are the taller elements of the complex, Building B (425 feet) and Building C (475 feet). Buildings B and C each will have a distinctive base, shaft, and sculpted crown.

Building A (approximately 277 feet) is located on Nashua Street behind the GSA building and next to the west facade of the arena. The street treatment of Building A uses many of the same concepts as the buildings on Causeway Street: a base element defining the street wall, expressed as an arcade entry at street level, with a taller element set back from the base. Building A will also have a distinctive base, shaft, and sculpted crown.

Buildings B and C bracket the portal formed by the Public Concourse. As the tallest element in the composition, Building C also defines the edge of the Central Artery. Approaching the complex from the north on the Central Artery new Charles River crossing, the complex rises as a series of dramatic elements. The northeast corner of the arena is defined by its curving cut-away long span roof, by a lantern and spire, and by a perforated metal marquee wrapping around the corner. The arena steps up from the Central Artery ramp structure. Buildings C and B rise from behind the arena. Seen from the highway, the commuter rail tracks, and the north side of the Charles River, this set of structures defines a new northern gateway to the City of Boston. When approaching the complex from the west, the buildings will appear to be clustered around and rising from Building A. Pedestrians approaching the project on Canal Street from Government Center and the Financial District will see the portal of the Public Concourse on axis with the street. The top of the arena will rise above the Public Concourse. Buildings B and C will serve as landmark elements, locating the site as an important transportation and entertainment destination.

Status of the Design

As has been noted elsewhere in this Draft EIR/PIR, the design of the new arena is more advanced than that of the commercial component (Buildings A, B, C, the Public Concourse, and Garage). The design of the New Boston Garden was presented (at the stage of design development) to the Boston Civic Design Commission on May 1, 1990. The Commission voted unanimously to endorse the arena design. The commercial component is still at a conceptual stage of design: schematic design, including definition of the shape of the buildings and their tops, and definition of facade elements (e.g., fenestration) has not yet occurred.

The Pedestrian Environment

The proponent recognizes the importance of pedestrian circulation and the functional integration of uses, particularly at the ground level, to the ultimate success of the entire project. As a result, considerable planning has occurred to define the ground plane of the site, focusing on the Public Concourse and its relationships to:

- MBTA Facilities - commuter rail platforms and cross platform, commuter rail ticketing, information booth and back office space, the Orange Line and Green Line superplatform, and the MBTA underground garage

- The New Boston Garden - arena ticketing, vertical transportation to the arena, and the project underground garage

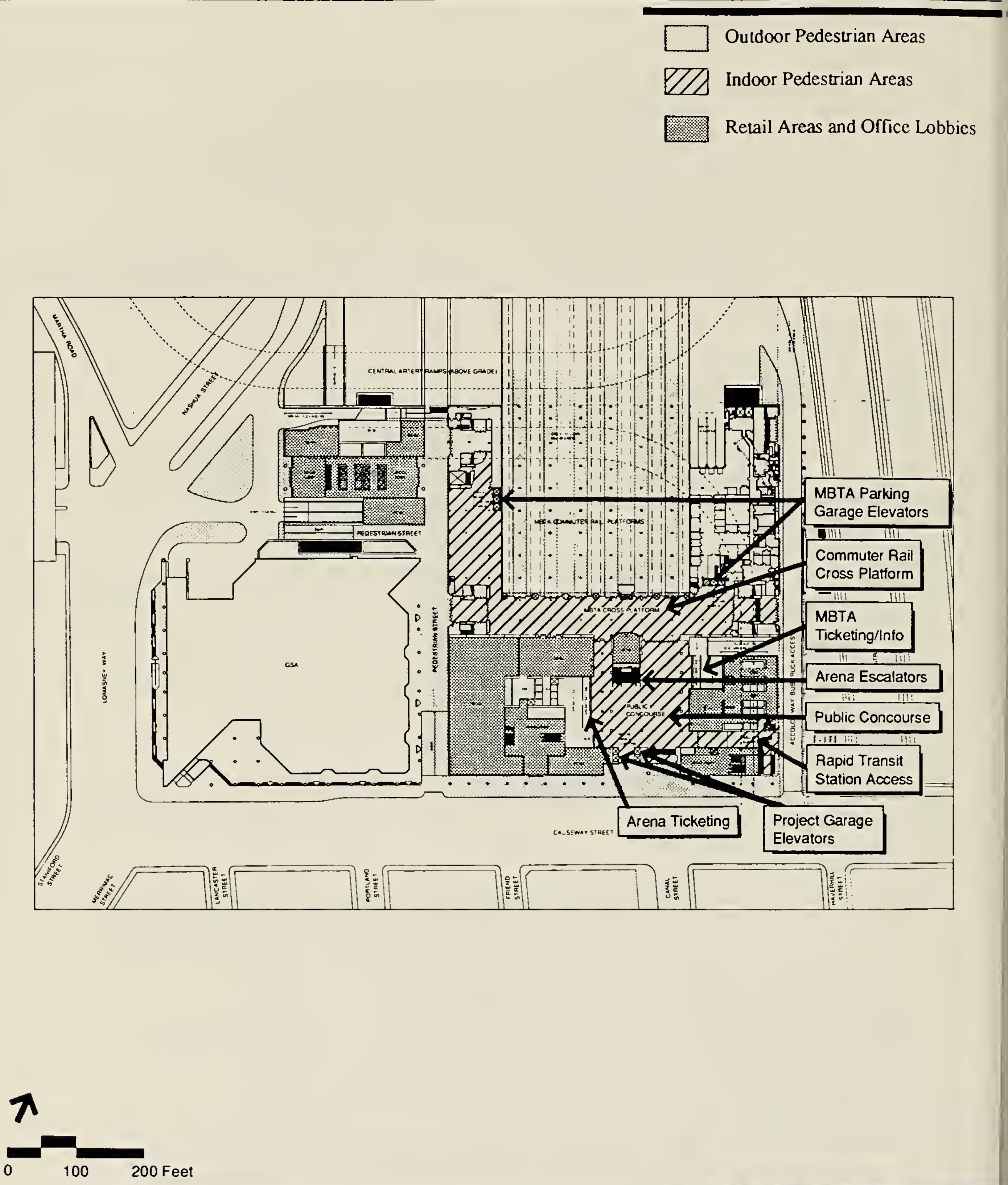
- Commercial Component - retail areas and office lobbies

- Public Walkways on the Site - new and expanded sidewalks along Causeway Street; new pedestrian walkways to the west of Building B and the new arena, to the south of Building A, and along Accolon Way to the east of the arena and Building C

- Public Pathways and View Corridors in the Project Area - commuter paths to North Station, rapid transit, and commuter rail facilities; arena patron paths to the arena, area restaurants, and parking facilities; pedestrian pathways to residential areas, civic facilities, and parklands; and view corridors to and from the project site

For almost all of these uses, the Public Concourse serves as a focal point, providing access and information, creating a lively presence on Causeway Street, and serving as a portal to the City and to the north.

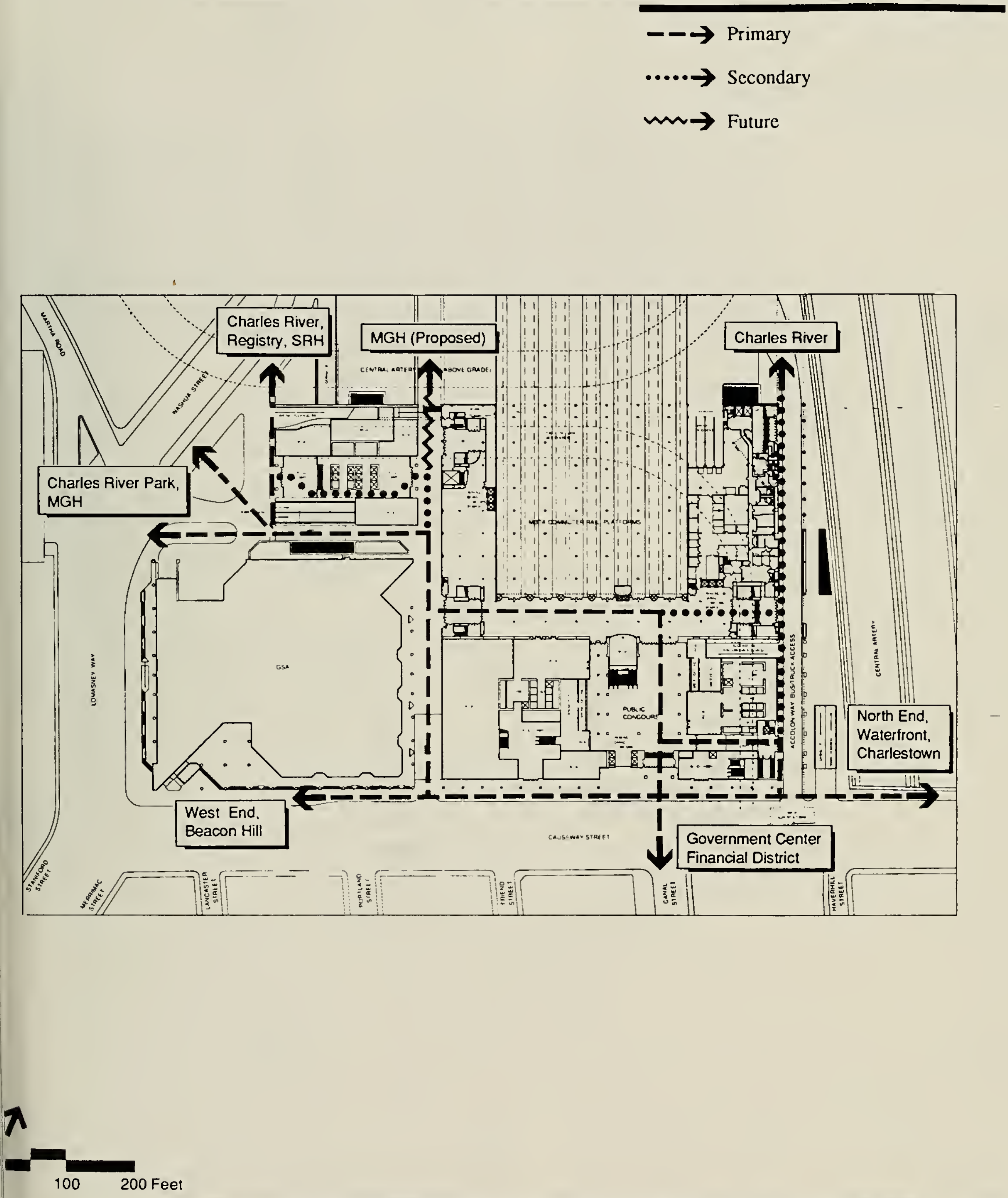
Nearly the entire ground plane of the New Boston Garden Development is planned as areas of public access or facilities of public accommodation (see Figure IV-D-1). A diagram of pedestrian pathways in the project areas is presented in Figure IV-D-2.



Vanasse Hangen Brustlin, Inc.

Pedestrian Areas

Figure IV-D-1



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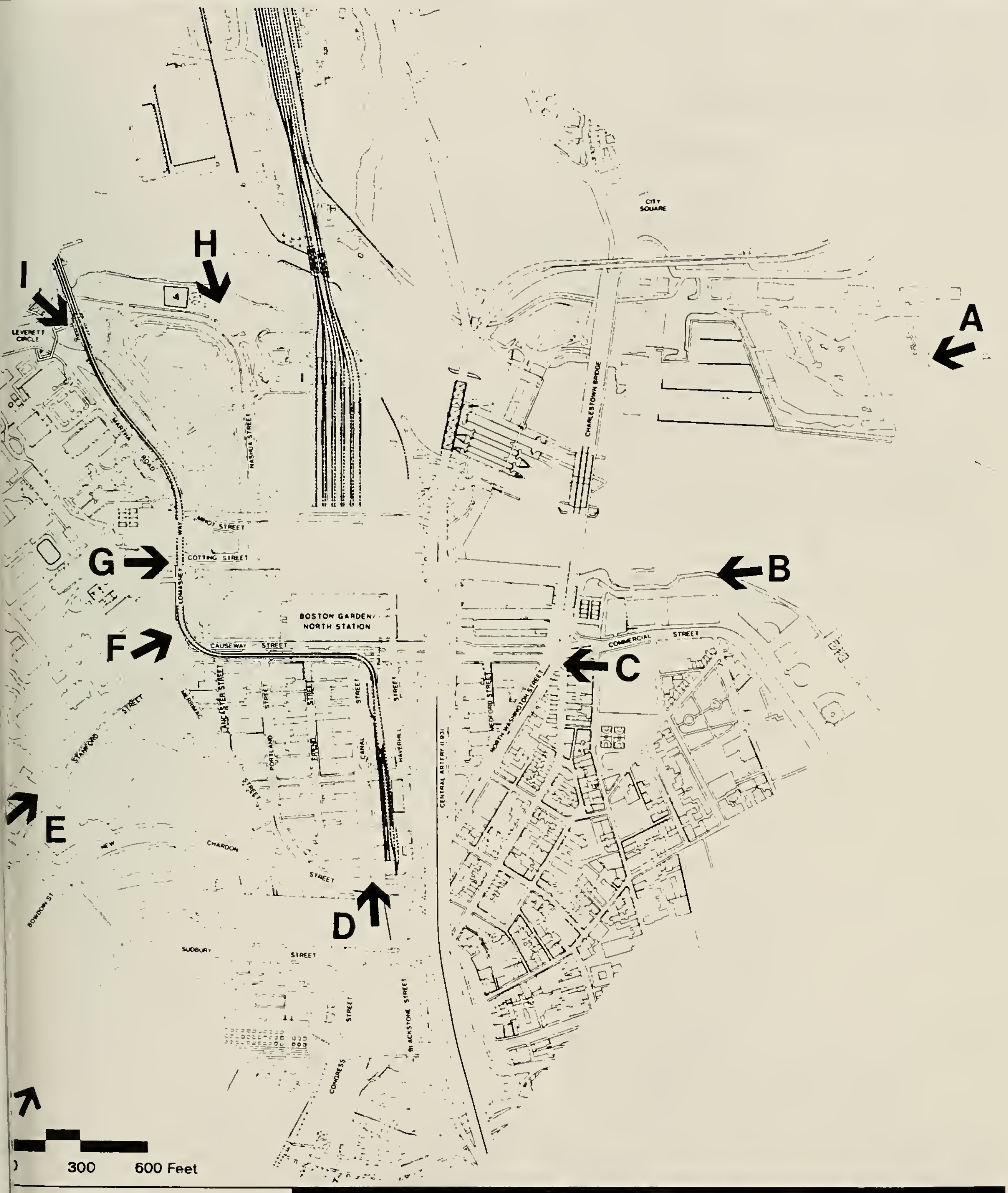
Pedestrian Pathways

Figure IV-D-2

VISUAL QUALITY ANALYSIS

The following sketches and discussion describe the urban design characteristics of the New Boston Garden Development and identify urban design effects on the visual environment likely to result. The effects of the development are described through nine pedestrian-level views taken from locations in the project vicinity. The accompanying map identifies the locations from which each of the nine views was taken (see Figure IV-D-3). Each set of views compares the Existing condition (No-Build) with 2000 Full-Build conditions. These drawings are based on computer-generated, three-dimensional visual modeling from set distances along specific view corridors to produce an accurate representation of what would actually be seen by the pedestrian viewer.



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Views Analyzed

Figure IV-D-3

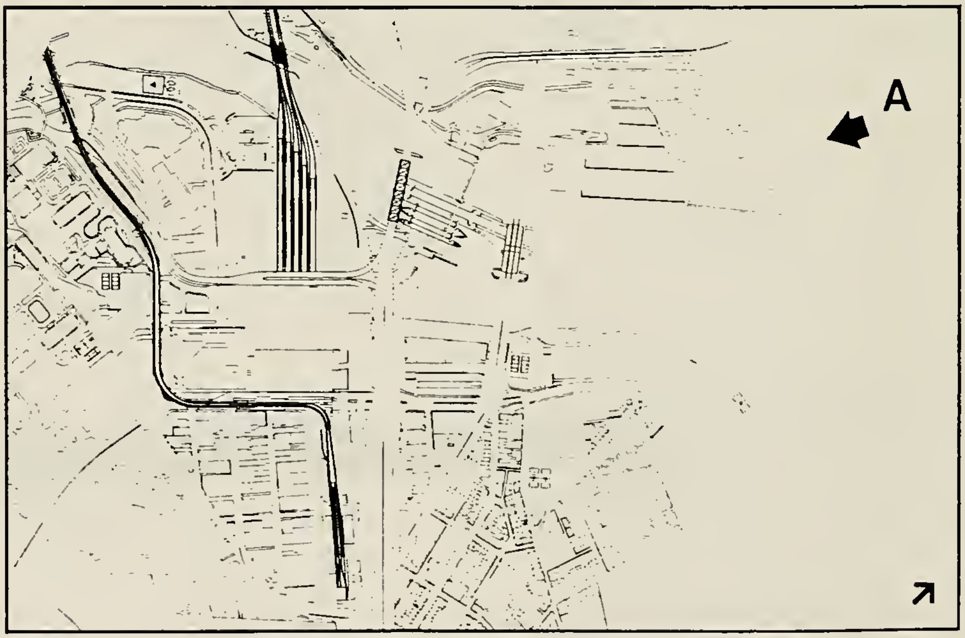
VIEW A: USS CONSTITUTION

Existing Conditions

In this view from Pier 1 at the Charlestown Navy Yard, the bowsprit of the U.S.S. Constitution and the pier by which she is berthed form the foreground. The midground is occupied primarily by water and by the office building and landscaped open space at Hoosac Pier. The New Boston Garden site is located in the background, behind the Anelex Building (150 Causeway Street). The buildings of the Financial District and the Government Center area form the horizon to the left of the view. Right of center in this view, the horizon is formed by the Hancock Building and the tops of the towers at Charles River Park and at MGH. Due to variations in distance from the viewpoint and topography of the city, most of the buildings in this view appear to be approximately the same height. A small portion of the Central Artery Charles River crossing is visible as immediate foreground to the 150 Causeway Street building.

Proposed Project

The New Boston Garden Development creates a strong presence on this part of the Boston skyline, announcing a new entry to the City at North Station. Due to its location, Building C is the strongest element of the view. It will act as a "beacon " for the New Boston Garden Development. The spire will be visible from many public areas north of the downtown, and it will orient pedestrians to the new arena and the new MBTA North Station commuter rail and rapid transit facilities. Building B appears behind (right) of Building C. Building A is partially obscured by the bowsprit of the U.S.S. Constitution, and it is not clearly related to Buildings B and C due to its position on the north side of the GSA Building (not visible in this view). The curving roof of the new arena and a portion of its east facade is visible above the Hoosac Pier building. The new Charles River crossing of the Central Artery is not visible in this view.



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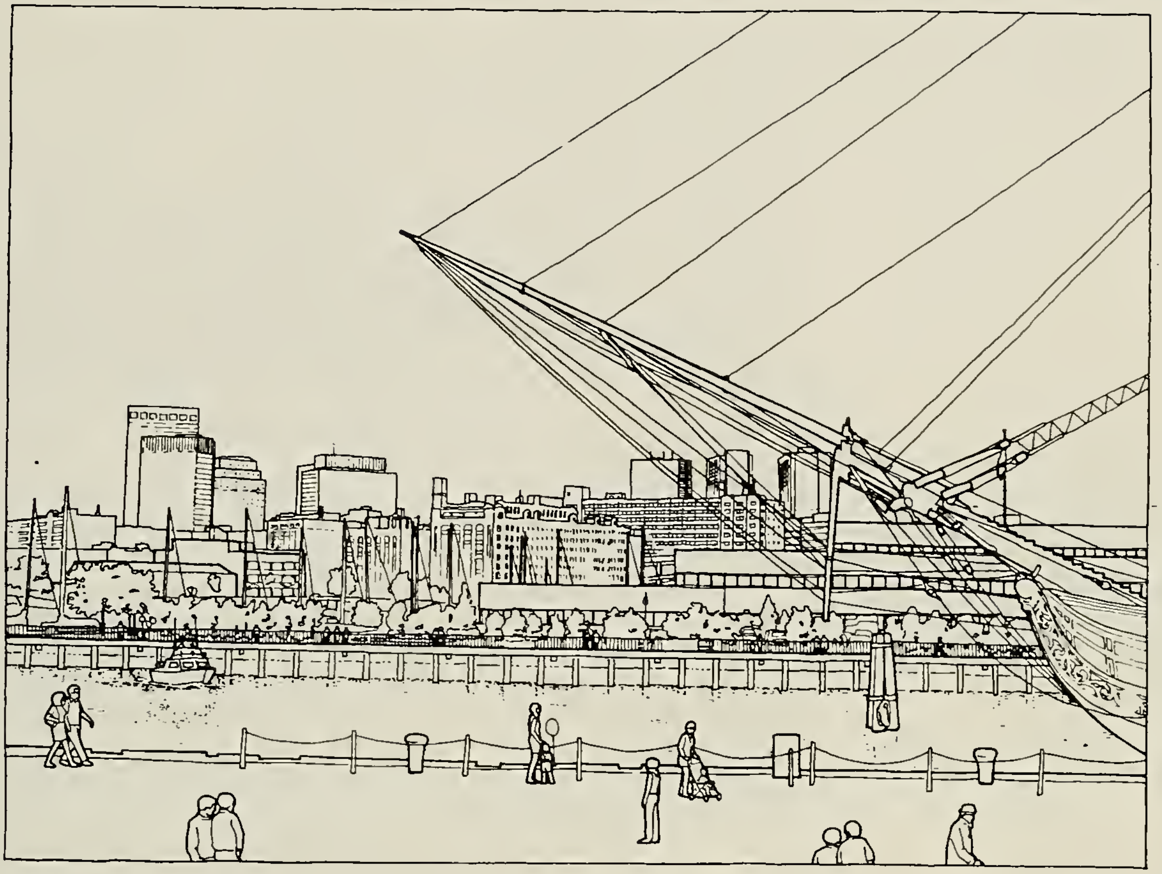
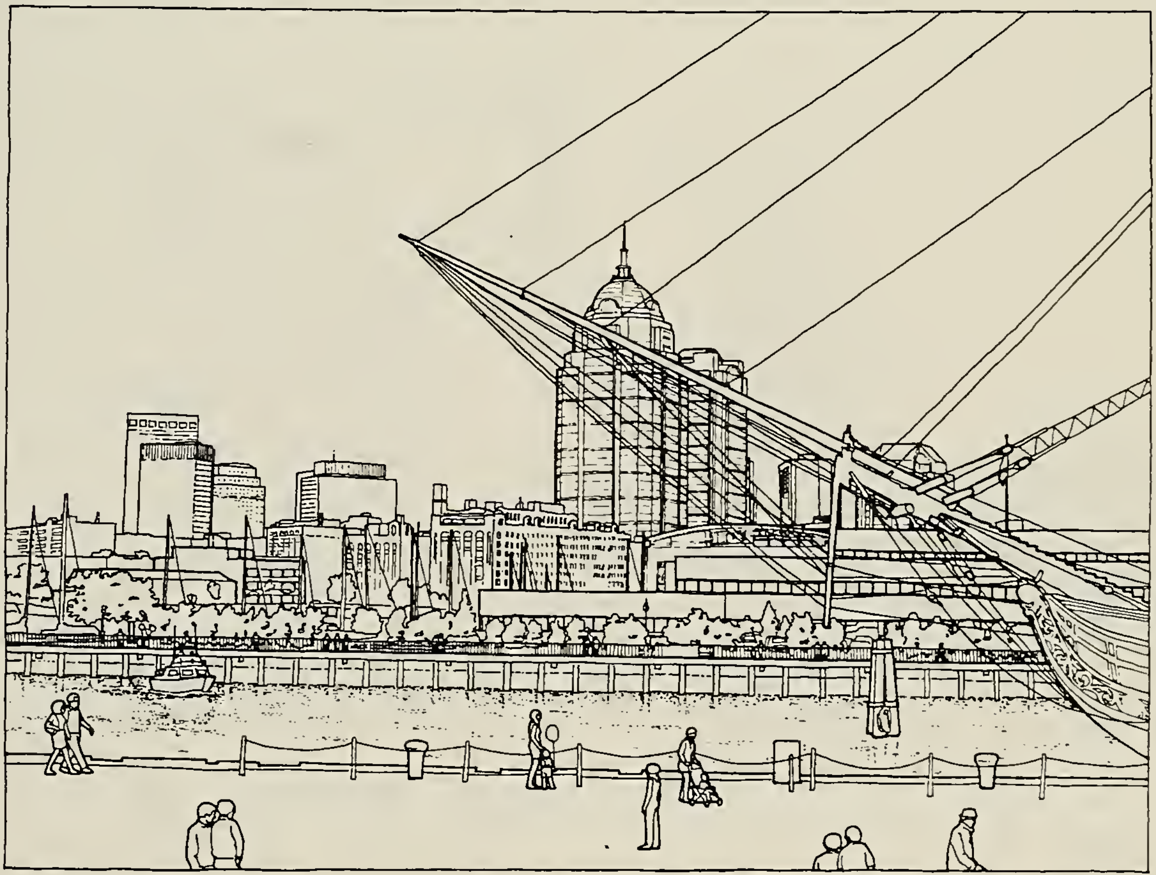
View A

U.S.S.
Constitution



Existing



Source: Thomson, French & Associates, Inc

Proposed

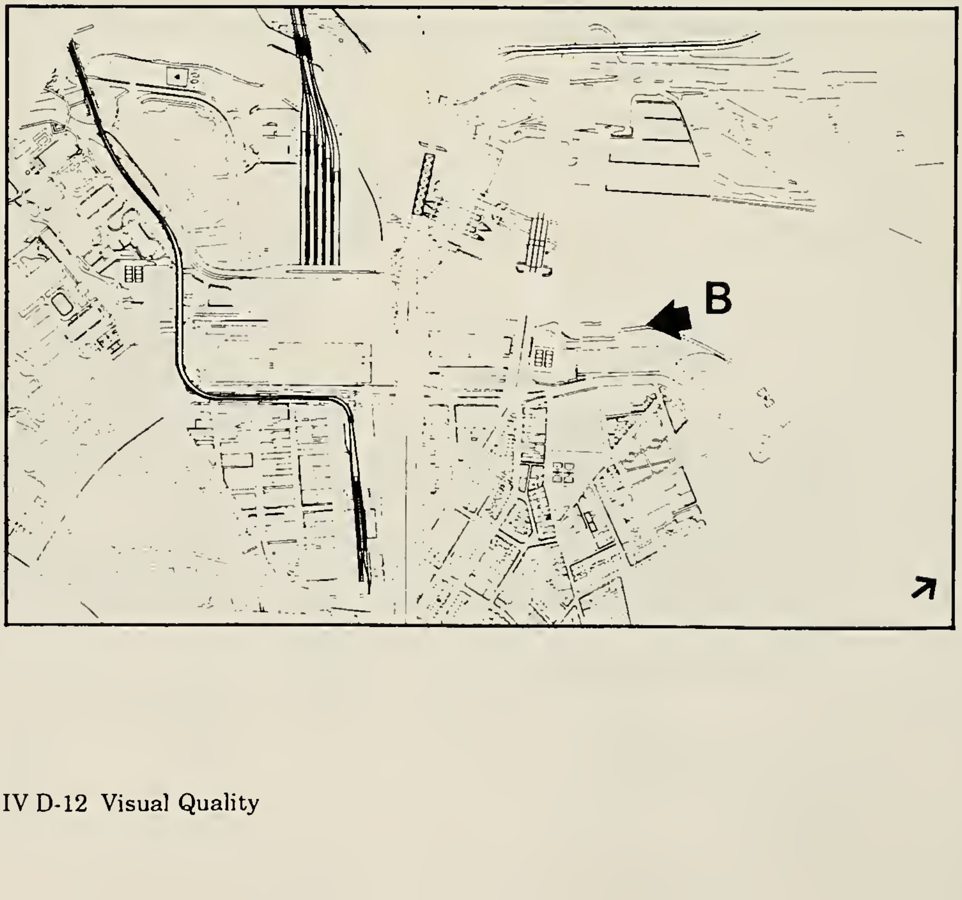
VIEW B: NORTH END WATERFRONT PARK

Existing Conditions

This view is seen from the North End Waterfront Park behind the MDC skating rink, looking toward the west/southwest. In the foreground is the park walkway and the Charles River. In the background on the left is the Stop & Shop bakery building, the Hoffman Building, and the Central Artery Charles River Bridge. In the background are the Anelex Building (center), and the top of a new building at MGH, the Registry of Motor Vehicles, and the Suffolk County Jail.

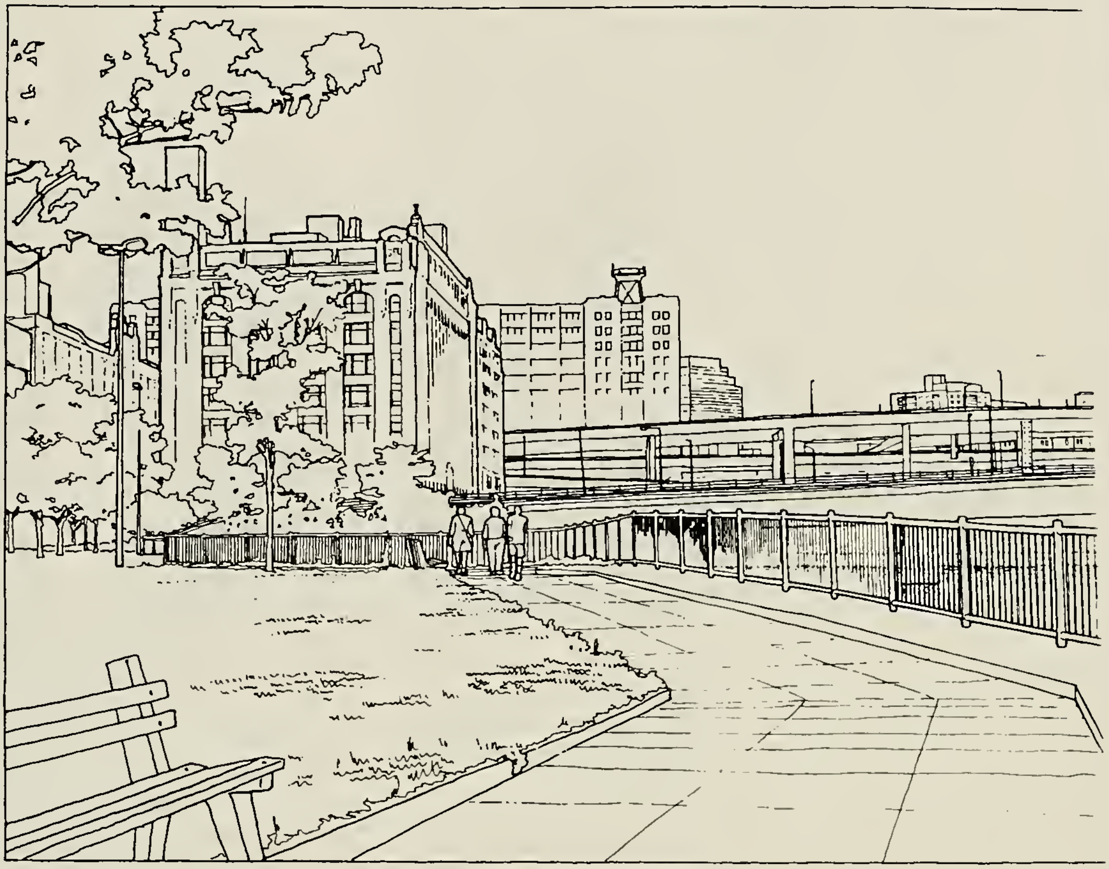
Proposed Project

The New Boston Garden's east facade is a dramatic new addition to the landscape. With its curving roof, tower, and other sculptural elements of the facade, the Boston Garden adds visual interest to the view. The view of the building is enhanced by the new, lower Central Artery Charles River Bridge. The ramps to Leverett Circle are now visible in the view. (This view illustrates the Charles River Bridge in its current design, as presented in the MDPW plans. The design of the bridge may be changed in response to comments on the Central Artery Draft Supplemental EIS/R.) Behind the New Boston Garden, Building A, with its faceted top, is visible. The massing and scale of Building A (and its facade treatment) will reinforce its role as a transitional element between the buildings to the right in this view, the arena and the larger Buildings B and C. Buildings C and B rise up behind the Hoffman Building, announcing a new arrival point to the city. The buildings in the proposed project step up from the river in much the same fashion as the existing buildings do today.



View B

North End Waterfront Park



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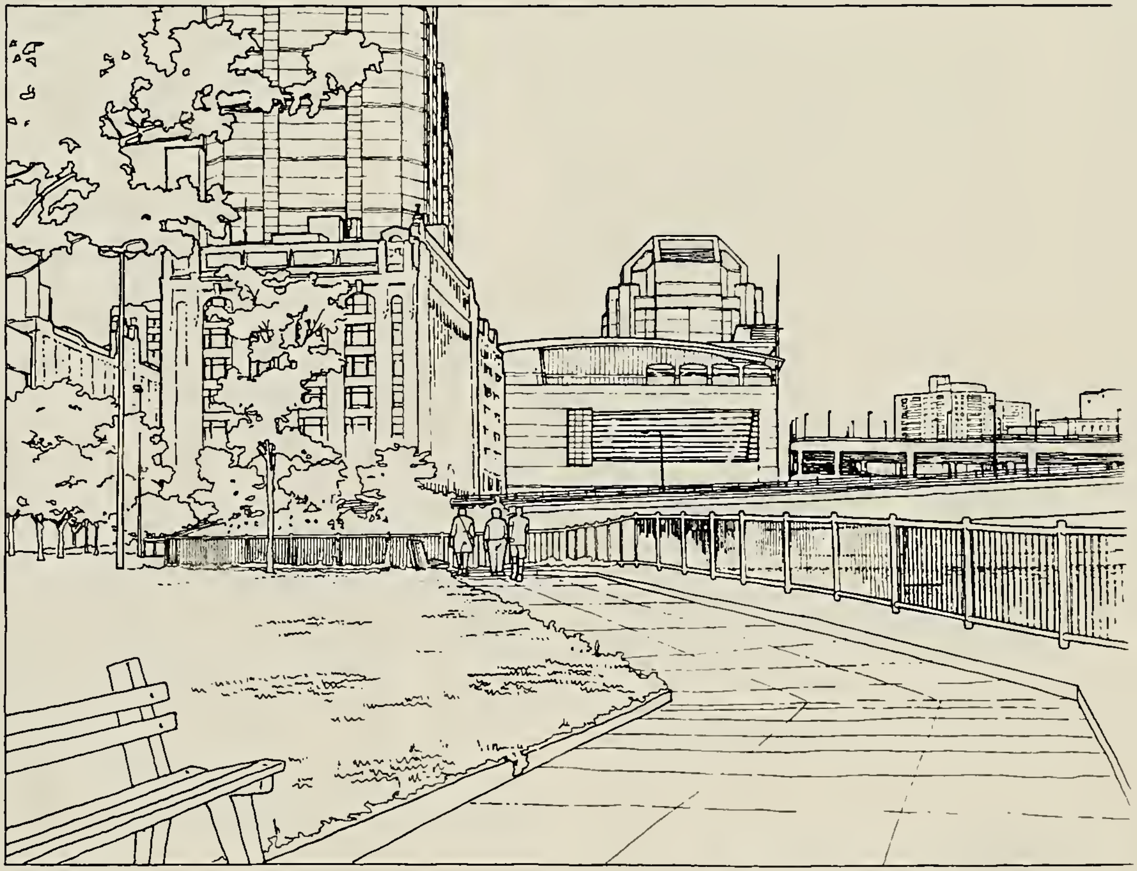


Source: Thomson, French & Associates, In

Proposed

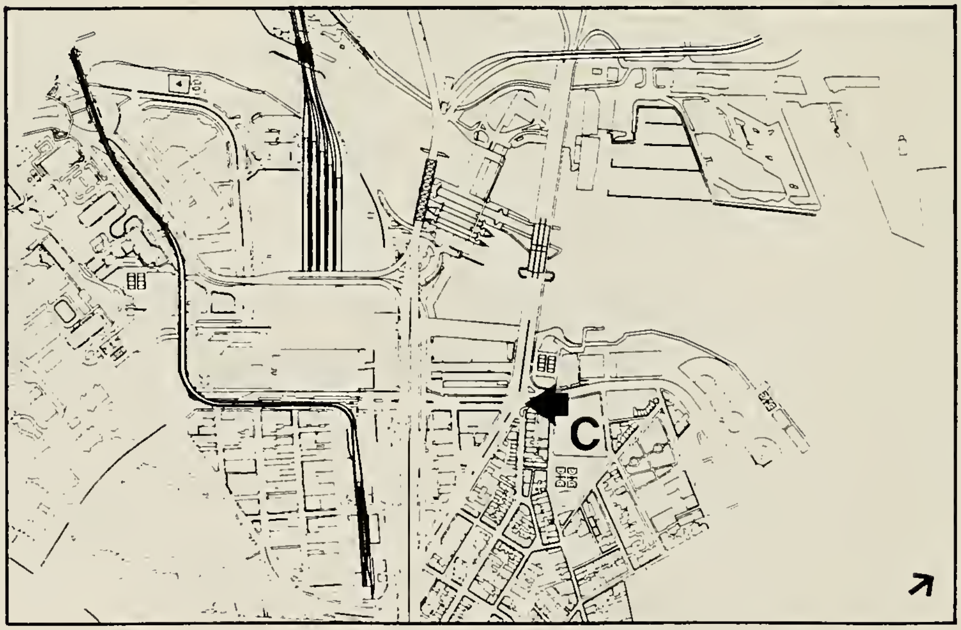
VIEW C: KEANEY SQUARE/CAUSEWAY STREET

Existing Conditions

This view looking southwest up Causeway Street from Keaney Square is an urban view framed on either side by existing commercial buildings of varying height, architectural style, and quality. The center of the view is established by the Central Artery and Charles River Park high-rise residential building (Longfellow Place). In the foreground, streets, sidewalks, and crosswalks take up much of the view. Much of the view of Causeway Street is taken up by the Central Artery and the elevated MBTA Green Line tracks, which in this view appear below the Central Artery. A portion of the Art Deco south facade of the existing Boston Garden is visible.

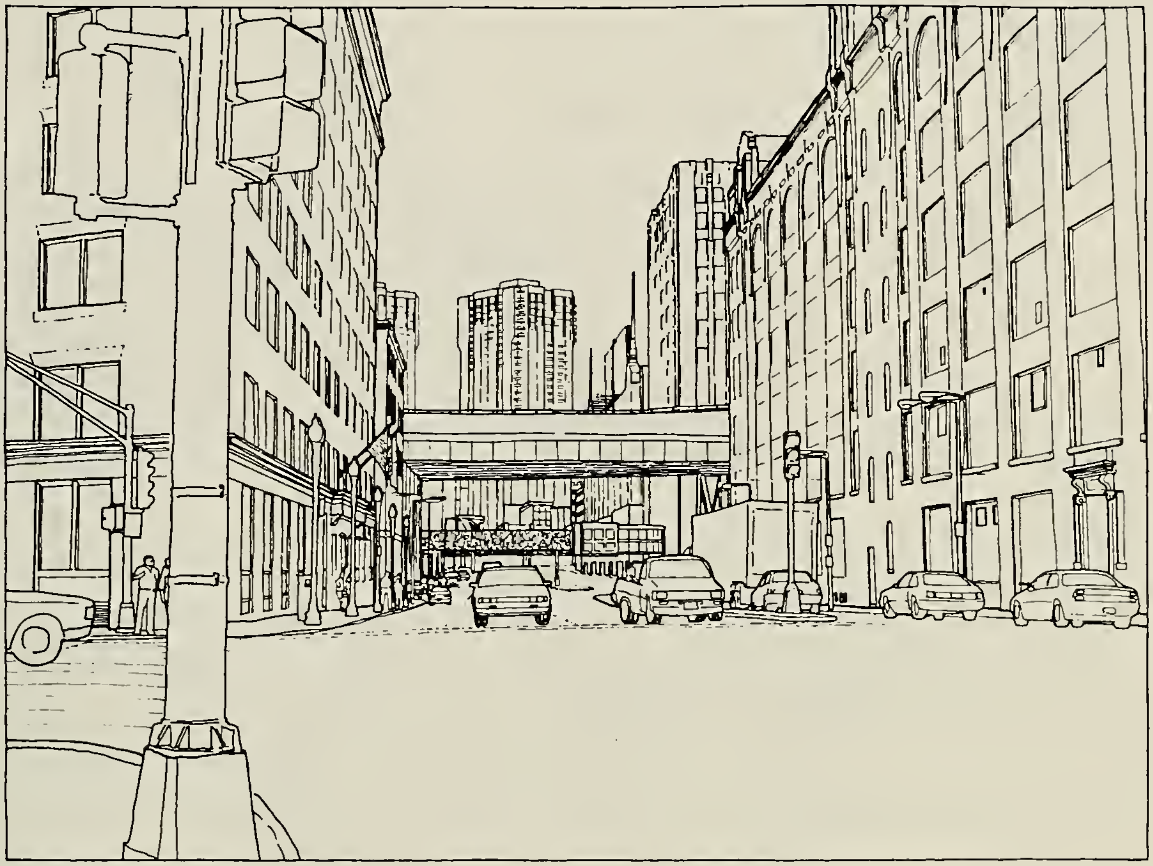
Proposed Project

This view of Causeway Street shows a dramatically altered urban landscape. The New Boston Garden Development appears on the right side of the street. Its base elements define a new street wall that is consistent with the height and character of the existing North Station and Bulfinch Triangle Buildings. The taller elements of Buildings C and B are set back from the street. The entrance to the Public Concourse may be inferred in this view by the notch in the bases of Buildings C and B. The removal of the Central Artery and the elevated Green Line opens up views on the street. As a result, the GSA Building is visible on the right, beyond the New Boston Garden Development. The Charles River Park high-rise residential building (Longfellow Place) in the center of the view appears even taller than in existing conditions. The proposed Lowell Square development would appear at the base of the Longfellow Place tower, but it is not shown in this view study. Trees planted in the median of Causeway Street block views of the pedestrian arcade at the New Boston Garden Development, but they contribute to a softer, less industrial appearance.



View C

Keany Square/
Causeway St.



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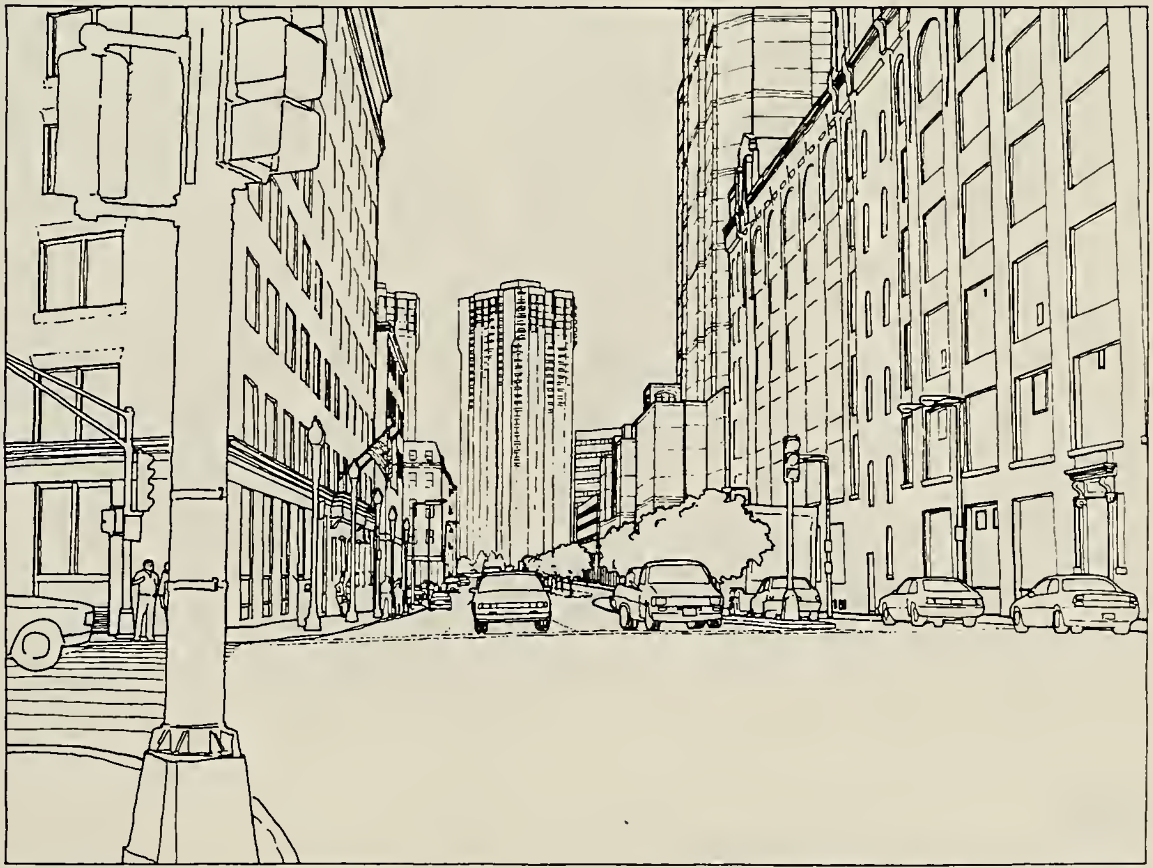


Proposed

Source Thomson, French & Associates, Inc

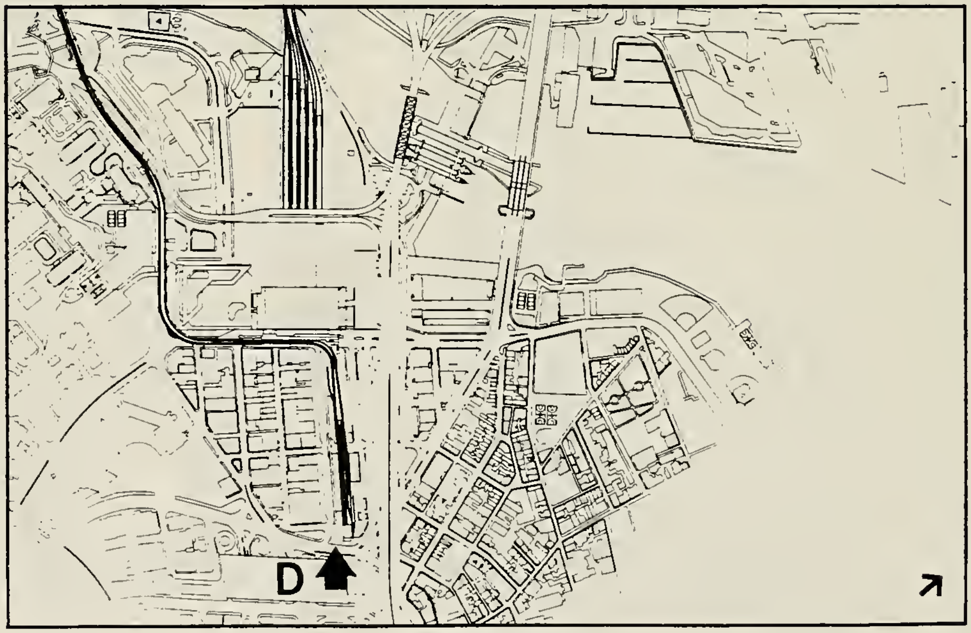
VIEW D: CANAL STREET

Existing Conditions

This view is looking northwest along Canal Street from the corner of Market Street toward the existing Boston Garden/North Station. The fence in the immediate foreground prevents access to vacant land at the corner. The Bullfinch Triangle buildings, street trees, and sidewalks define the scale and character of the district. Boston Garden and North Station are announced by the billboard atop the building and the partially obscured sign, an undefined end of this important pedestrian view corridor. A small portion of the Causeway Street facade of Boston Garden is visible, and at the street, a bit of the arcade can also be seen. The elevated Green Line is visible at the end of Canal Street at Causeway Street.

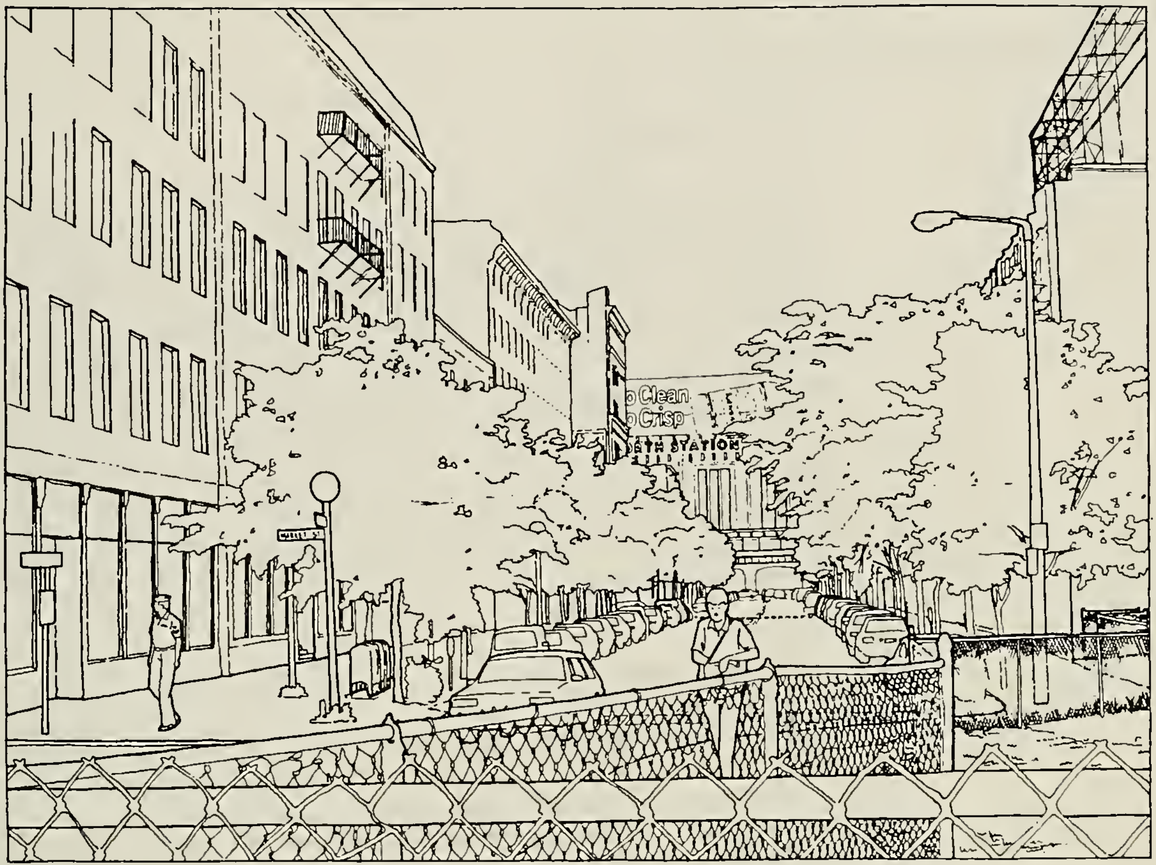
Future Conditions

Buildings B (left) and C (right) frame the view down Canal Street on the skyline. In this view, the tops of Building B and C are not visible. However, an upward glance would bring the tops of these buildings and their crown elements into view. The entrance to the Public Concourse, the New Boston Garden, and North Station is on axis with Canal Street and is the focal point of the pedestrian streetscape. This important public entry is announced by an arch (or other architectural elements) and new signage. The classical symmetry of the street facades and the portal to the new arena and North Station is planned as a new civic image for the City of Boston, one that celebrates the public's gateway to the City. The top and roof of the New Boston Garden is visible behind the Public Concourse.



View D

Canal Street



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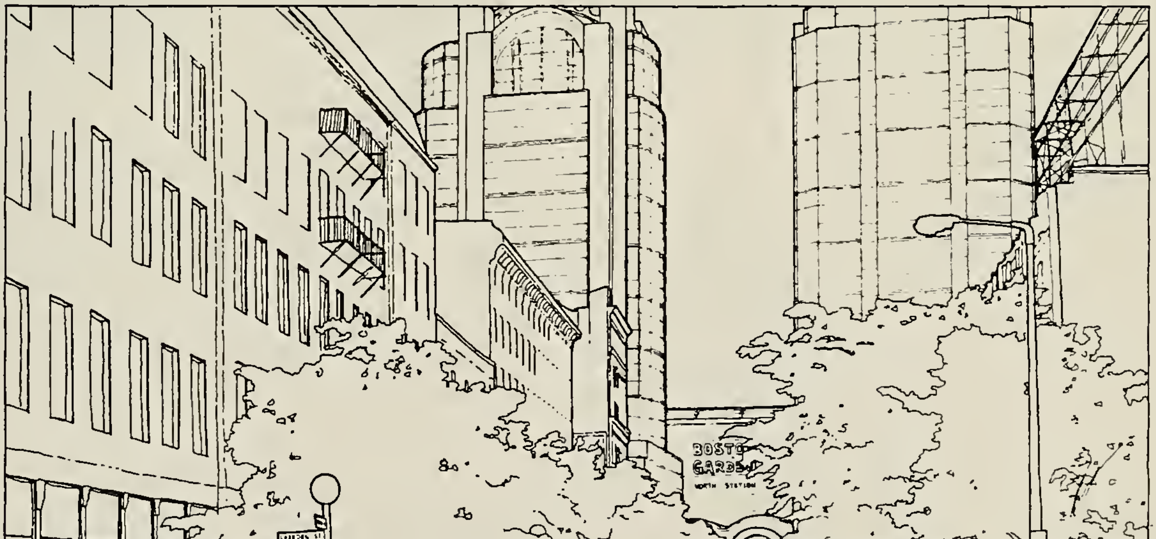


Proposed

Source: Thomson, French & Associates, Inc

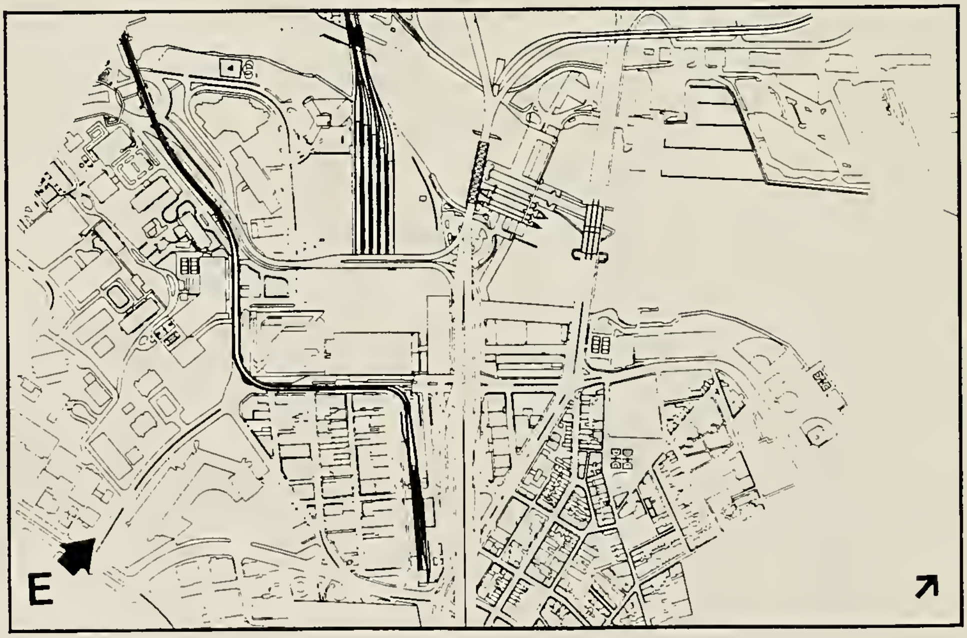
VIEW E: STANIFORD STREET

Existing Conditions

This view is seen from the entry to the Charles River Park Garage looking north to Lowell Square. This area appears to lack any strong urban design coherence, reflecting as it does the confluence of streets, architectural styles, and approaches to urban renewal. Much of the view is taken up by Staniford Street, its sidewalks, and the pedestrian plaza next to the shopping mall at Charles River Park on the left. On the right, the Lindemann Center (Hurley Building) looms above the viewer, presenting a nearly blank face at the sidewalk. Seen from this angle, the GSA Building is equally imposing. The only remaining elements visible from an earlier era are the six-story masonry building at 151 Merrimac Street (the northwest corner of the Bulfinch Triangle) and the elevated Green Line tracks. From this viewpoint, the 151 Merrimac Street building appears to be out of place with the architectural styles and materials of the surrounding structures.

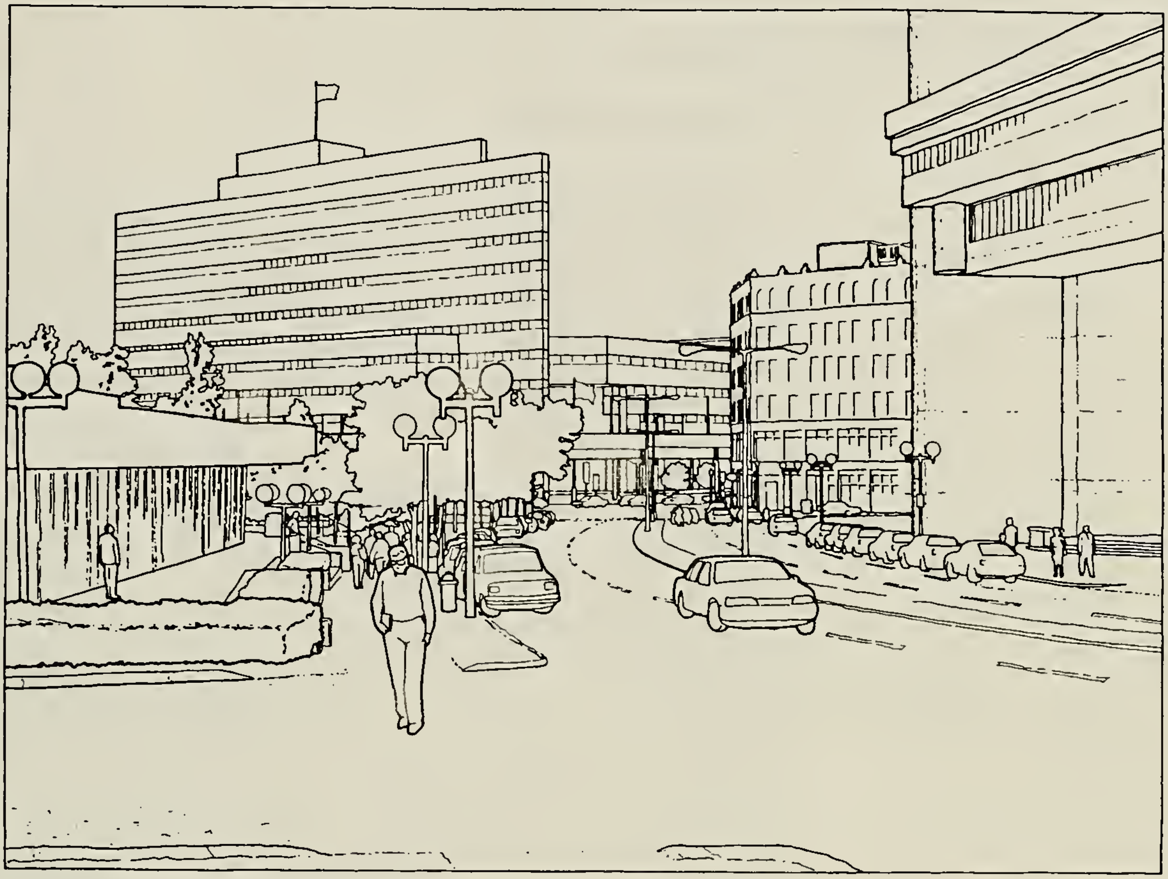
Proposed Project

The faceted top of Building A rises above the GSA Building to the left of the view. The curved roof of the New Boston Garden rises slightly above the lower section of the GSA Building in the center of the view. In both cases, these additions to the skyline add visual interest and draw the viewer past the GSA Building to pedestrian urban destinations beyond it. In this way, the project helps to mitigate effects of the sharp edge of the GSA Building that intrudes into Lowell Square. Part of Building B can be seen rising behind the 151 Merrimac building right of center in the picture. The removal of the elevated Green Line opens up Lowell Square, creating a sense of space and defining Causeway Street's location in the view.



View E

Staniford Street



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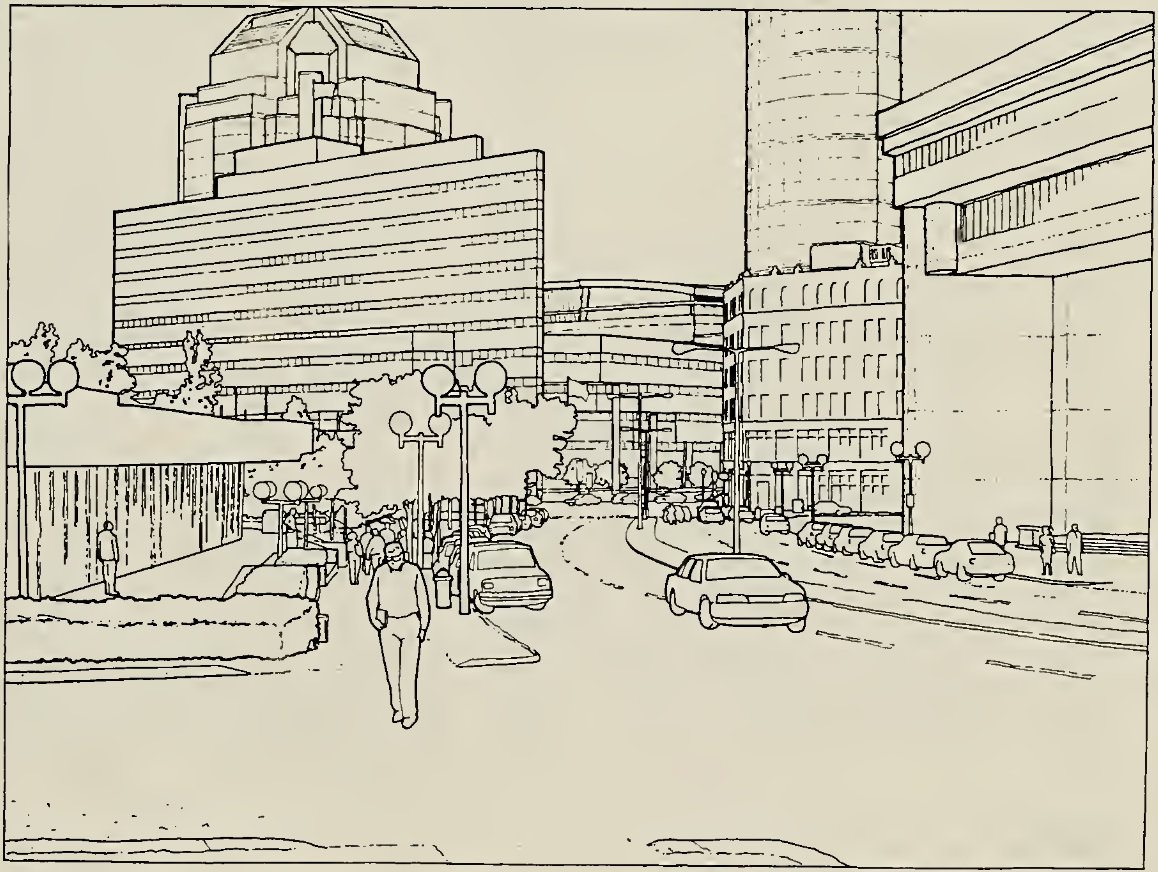


Source Thomson, French & Associates, Inc

Proposed

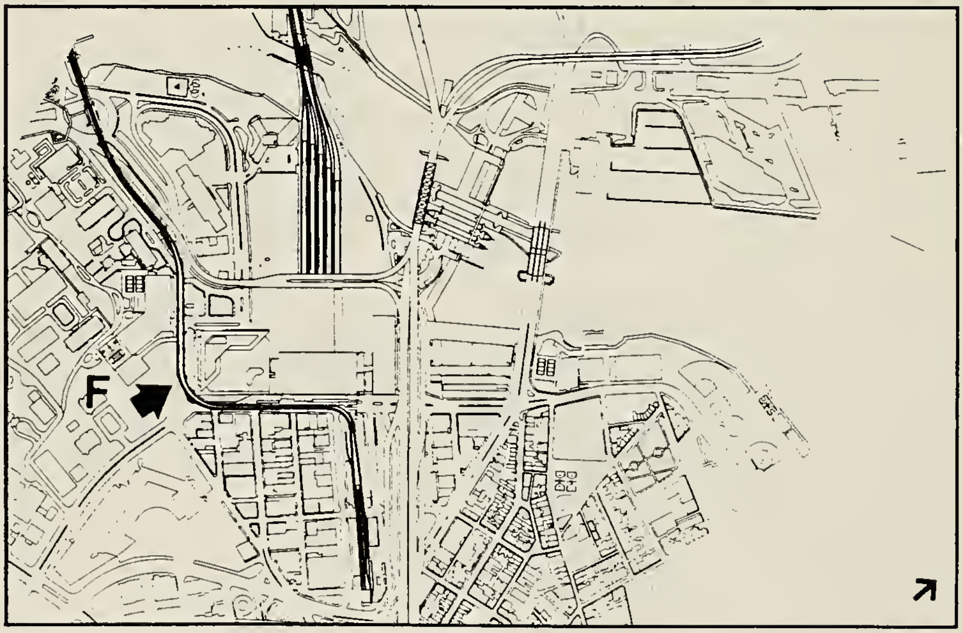
VIEW F: LOWELL SQUARE/CAUSEWAY STREET

Existing Conditions

Much of the view looking up Causeway Street to the northeast from Lowell Square is filled with the street itself and the elevated MBTA Green Line tracks. On the right, the 151 Merrimac Street building represents the northwest corner of the Bullfinch Triangle area. The GSA Building, Boston Garden/North Station, and 150 Causeway Street can be seen above the elevated tracks. The GSA Building stands in stark contrast with the older structures. Little of the streetscape on the north side of Causeway Street can be seen due to the presence of the elevated Green Line tracks.

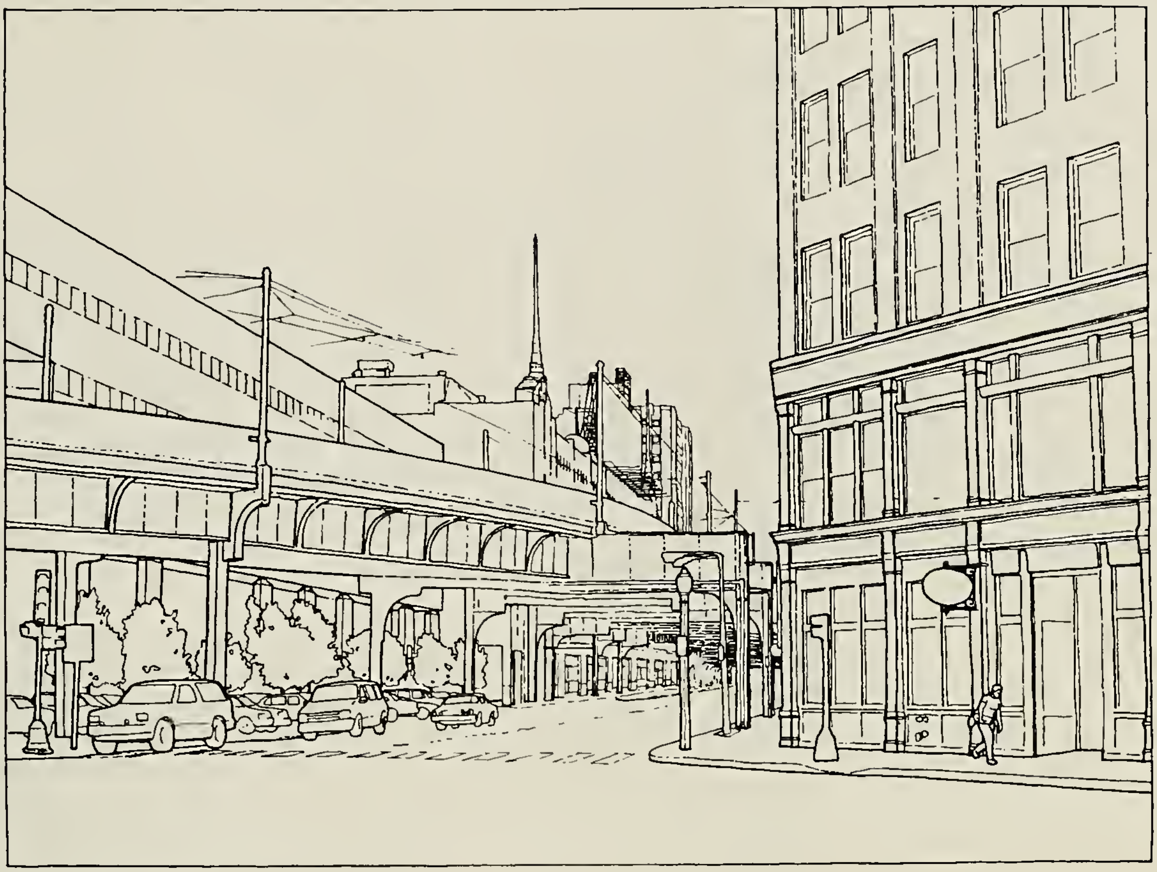
Proposed Project

This view shows a transformation of Causeway Street, occurring as a result of the New Boston Garden Development, the removal of the elevated Green Line, and proposed street improvements by the Commonwealth. The view up Causeway Street is clear, except for the street trees on the median, which add pedestrian scale, color, and movement to the street. The bases of Buildings B and A extend to the massing of the GSA Building and to the existing, older structures of the Bulfinch Triangle, creating "paired" street walls on Causeway Street. The columns of the arcaded area on the south facade of the GSA Building are carried through as a pedestrian arcade and broad sidewalk at the New Boston Garden Development. A notch in the base element of the development indicates the presence of the entry to the Public Concourse. Buildings B and C represent major new features in the view, set back from and rising out of the lower-scaled base. The Hoffman Building is now visible on the north side of Causeway Street near the center of the view. The gap between the base of Building C and the Hoffman Building defines the corridor for the depressed Central Artery.



View F

Lowell Square/
Causeway St.



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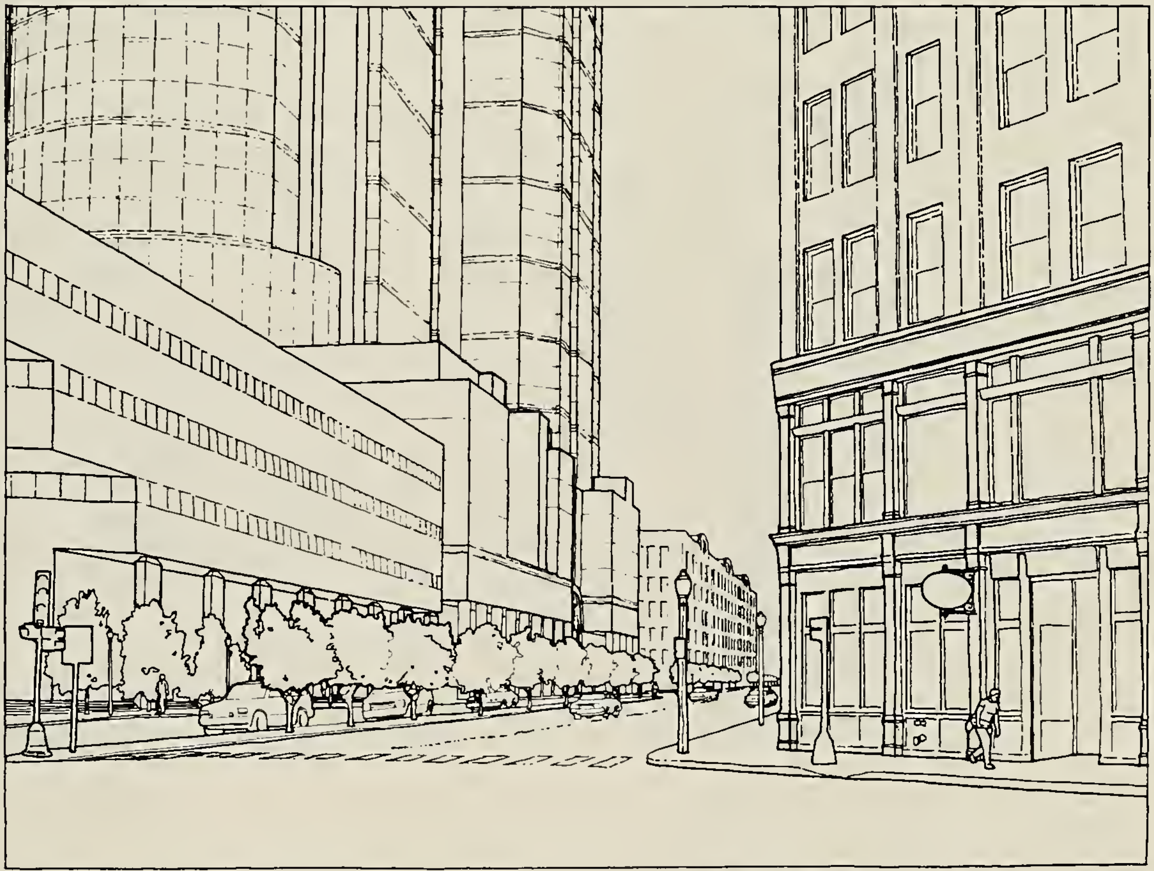


Source: Thomson, French & Associates, Inc

Proposed

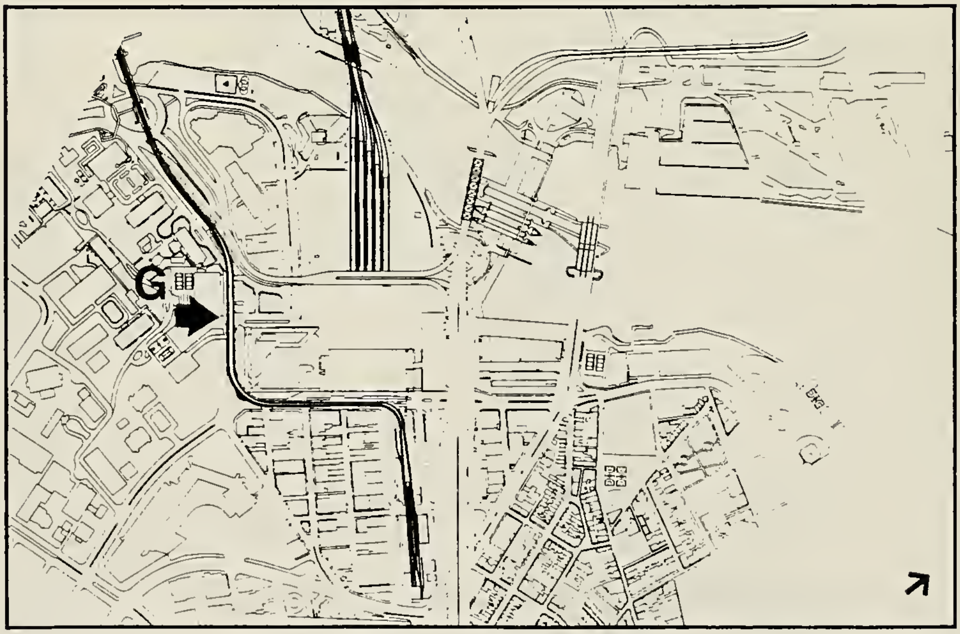
VIEW G: COTTING STREET

Existing Conditions

In this view looking northeast from the front of the Charles River Park Garage, Lomasney Street is visible in the foreground and Cotting Street leads toward the site of construction for the new MBTA underground garage. On the right is the northwest corner of the GSA Building with a driveway providing access to its garage and loading dock. In the background, the Central Artery mainline and ramps (to the left) are visible. The west facade at the rear of 150 Causeway Street is visible in the center of the view. The project site appears to be a "no man's land" in this view. The elevated Green Line tracks cut off the sky and part of the view of the GSA Building.

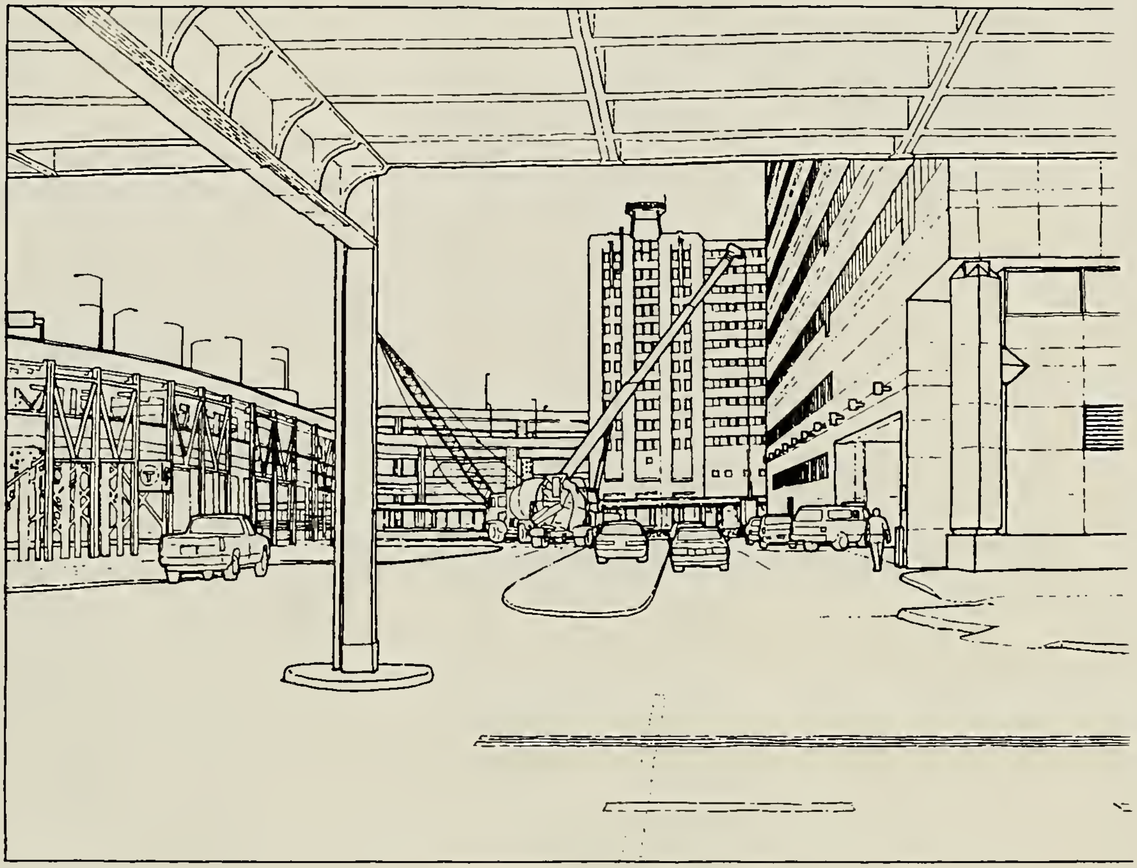
Proposed Project

In this view a new urban landscape has been created, defined by the entrance to Building A, the new pedestrian street between Building A and the GSA Building, and the west facade of New Boston Garden/North Station (appearing at the end of the pedestrian street). The entry to the New Boston Garden and North Station is visible, as is the entry to the MBTA and project garages. Access to the new complex is clearly defined from this viewpoint as a crosswalk leading to a broad pedestrian zone behind the GSA Building. Removal of the MBTA elevated Green Line opens up the view at the top. The New Boston Garden Development transforms a desolate parking lot into an active public commercial area and public access way to the new arena and North Station. The base of Building A, with its scaling elements, helps to reduce the visual impact of the GSA Building and provides a sense of "enclosure" on the public walkway.



View G

Cotting Street



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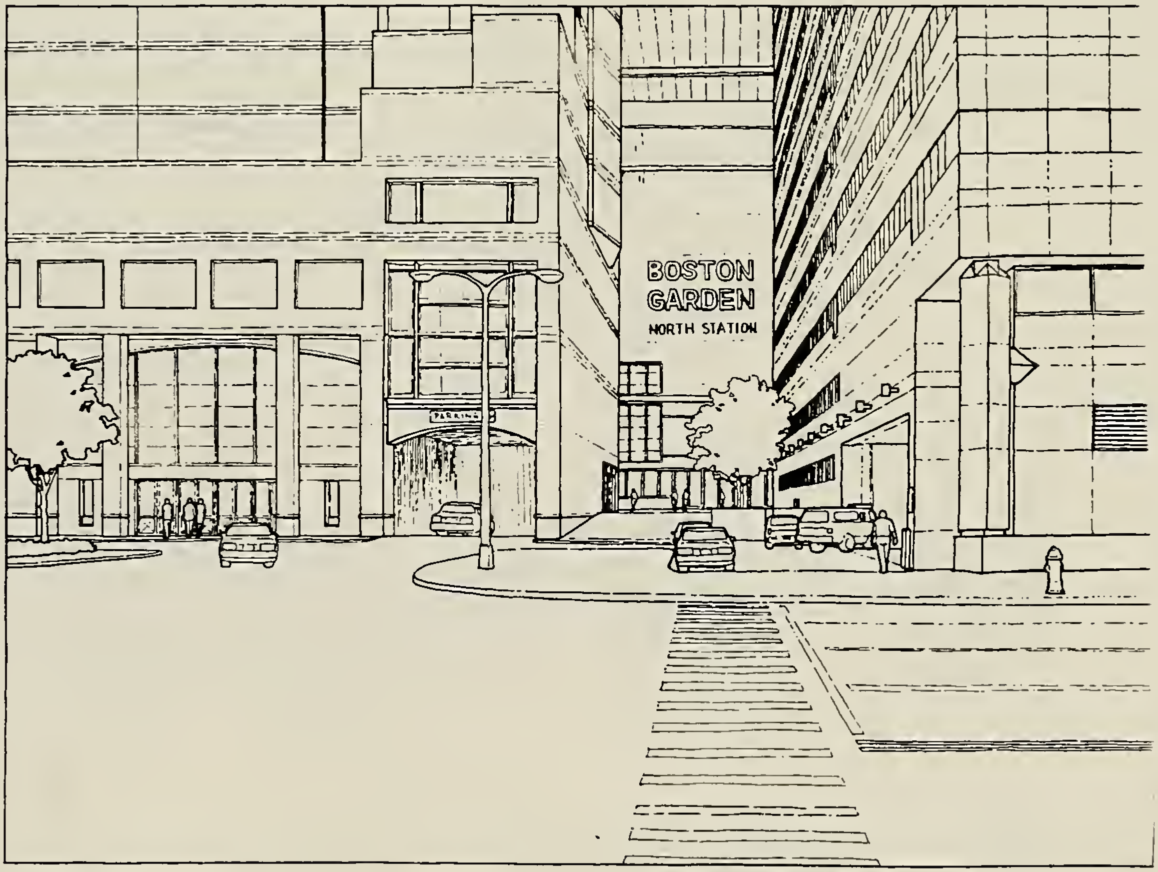


Source: Thomson, French & Associates, Inc

Proposed

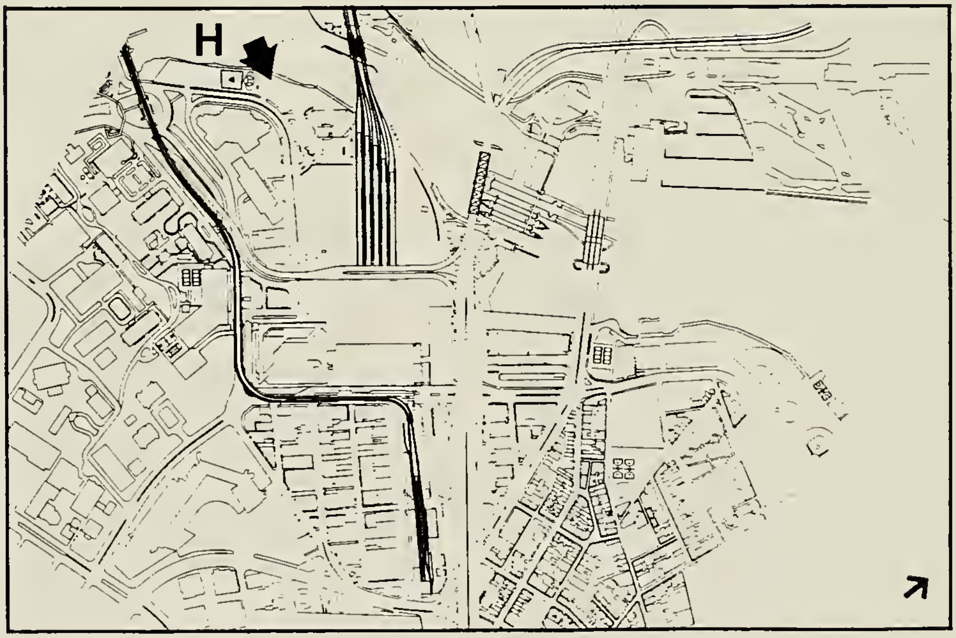
VIEW H: NASHUA STREET

Existing Conditions

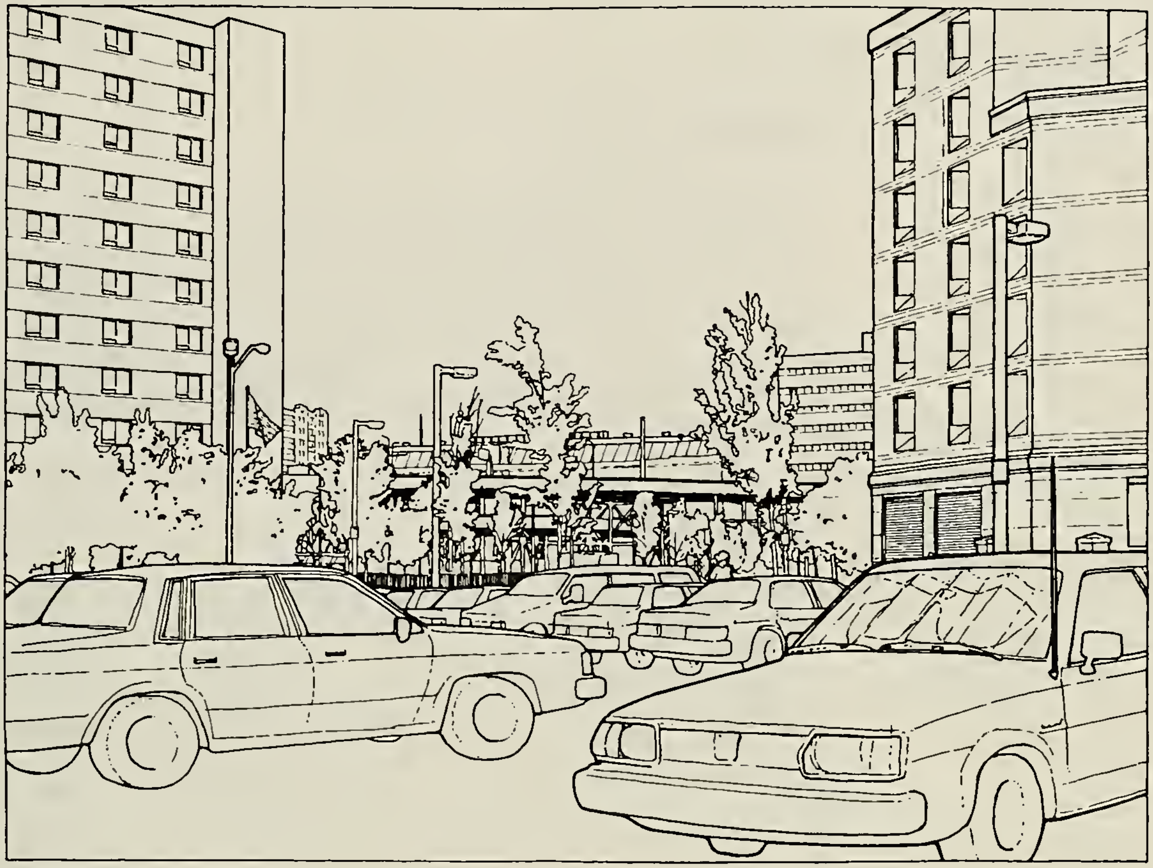
This view is looking southeast from the parking lot next to the Charles River and the heliport. The view is framed by the Spaulding Rehabilitation Hospital (left) and the new Suffolk County Jail (right), with the Central Artery ramps, Boston Garden, 150 Causeway Street, and GSA Building in the background. The project site is largely undefined in this view, and there is little to announce North Station, or for that matter downtown Boston from this vantage point along the Charles River.

Proposed Project

The foreground of this view is now taken up with the new riverfront park (Esplanade extension) to be created as part of the Central Artery project. This is one of the few locations from which most of the elements of the project are visible (the Public Concourse and the Causeway Street pedestrian arcade are not visible). The relationship of Building A (on the right) to Buildings B and C (center and left respectfully), is more clear than in other views studied here. The north and west facades of the New Boston Garden are also visible here, defining an important destination point. The proposed MGH development would appear in front of Building A and the New Boston Garden, but it is not shown in this view. The future street wall established by Building A and the new MGH development will tie the Spaulding Rehabilitation Hospital into a typical Boston street wall, in contrast to its current position as a stand alone object.



View H
Nashua Street



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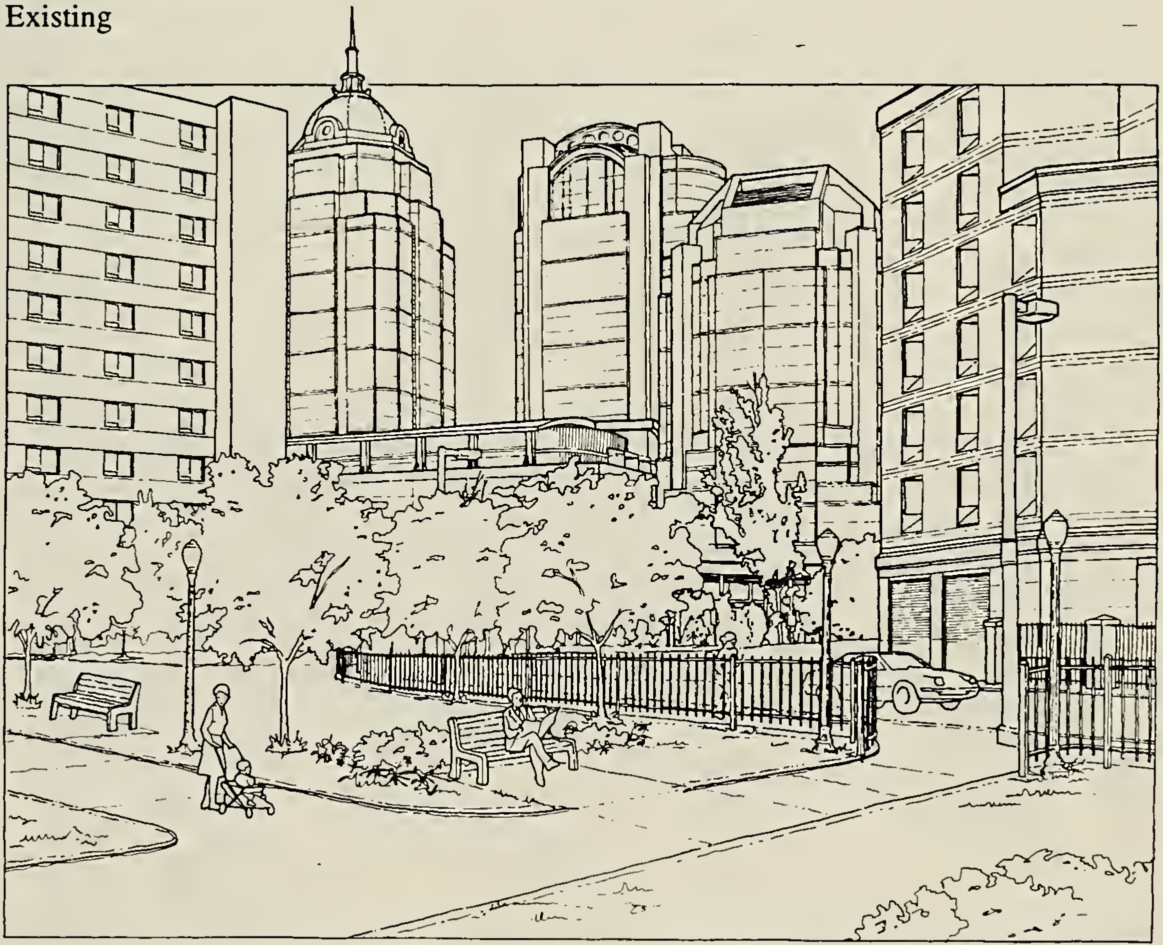


Source: Thomson, French & Associates, Inc.

Proposed

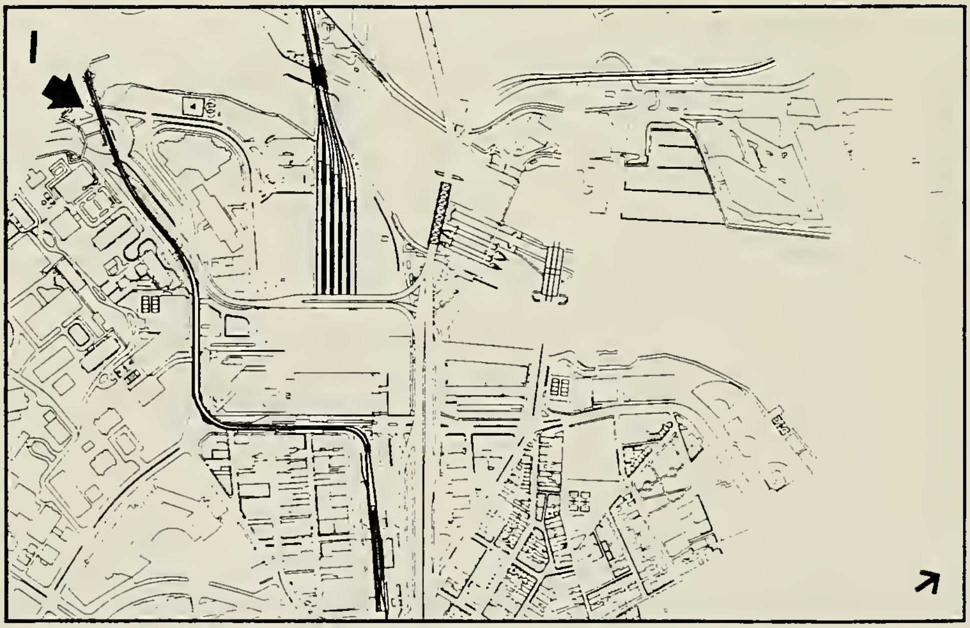
VIEW I: LEVERETT CIRCLE

Existing Conditions

The project site is barely visible from this location, standing on the Leverett Circle Pedestrian Bridge looking east-southeast. The principal features of the view are the ramp to the Central Artery (left) and Martha Road (right), with parking located between the two roadways. The elevated MBTA Green Line runs across the view from left to right, including Nashua Street at the far right. Also visible are the Registry of Motor Vehicles building, the Anelex Building, the GSA Building, Whittier Place and the Amy Lowell House in Charles River Park (on the right).

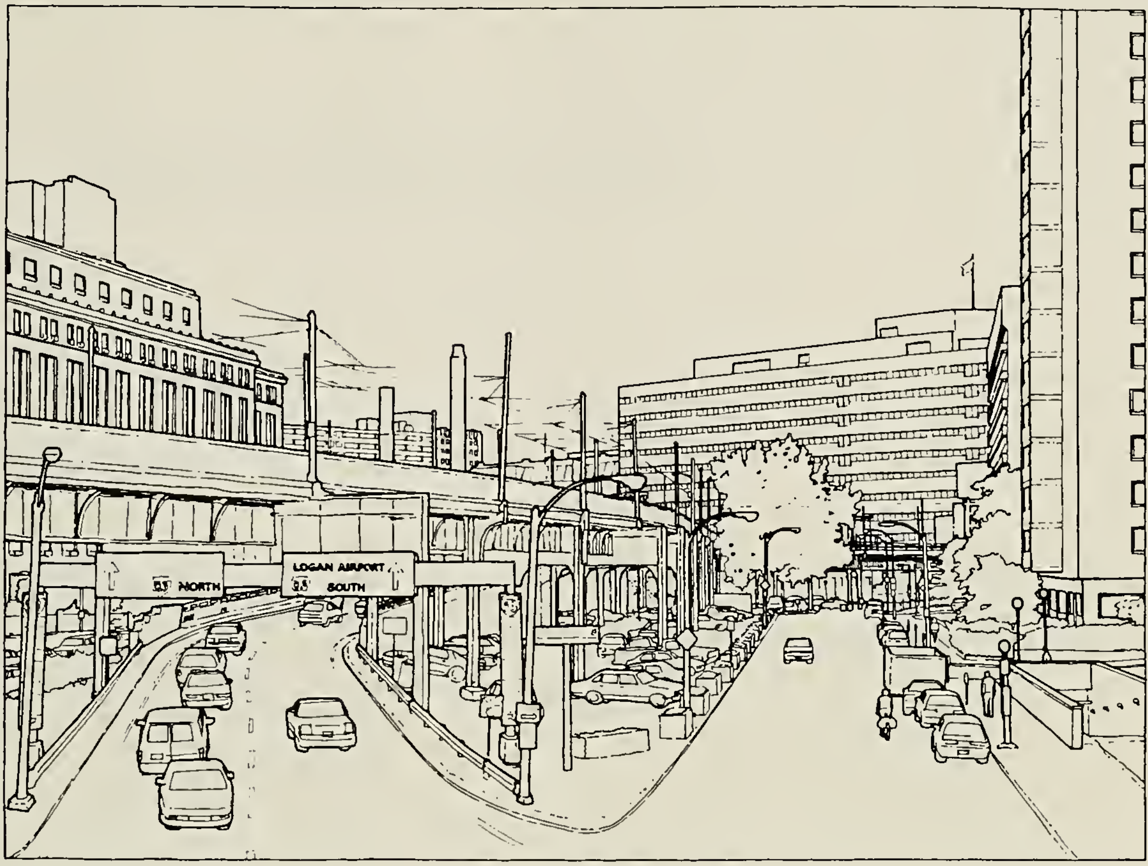
Proposed Project

Buildings C and B appear on the skyline in this view with Building A centered in front of them. A small part of the northwest corner of the New Boston Garden is visible left of center. The Green Line elevated tracks are now seen to be rising from a portal on Martha Road to the Science Park Station (just off the view on the left). Buildings A, B, and C, and the new arena redefine this view and draw the eye upward from the MBTA and roadway structures in the lower foreground. The new buildings create a sense of drama and excitement on the skyline: they define a new entry to the City from the north, act as an orientation device, and establish an important pedestrian destination.



View I

Leverett Circle



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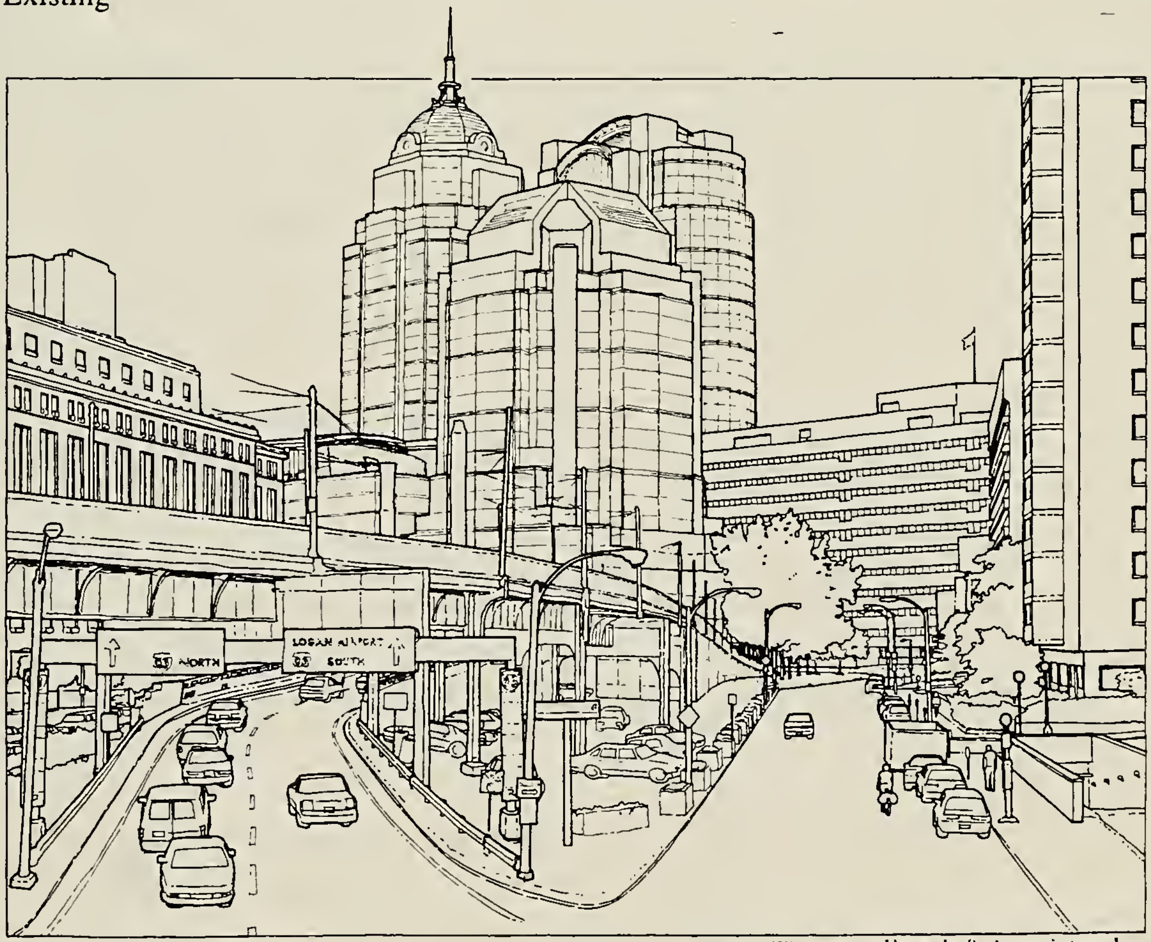

Proposed

Source: Thomson, French & Associates, Inc

E Historic Resources

INTRODUCTION

This section assesses the relationship of the New Boston Garden Development to the historic resources of the site and its environs. An overview of the historical setting and development history of the area is presented. The historic districts and individual features in the vicinity are described, as are the specific on-site historic resources. An assessment is made of the potential effects of the New Boston Garden Development upon historic resources. The section concludes with the identification of mitigation measures designed to minimize potential impacts. Specific attention is paid to the massing and scale of the New Boston Garden and the commercial component in relation to the adjacent historic district, as well as efforts to echo architectural elements of the historic features in the proposed development.

Information in this chapter responds to the Boston Redevelopment Authority (BRA) Scoping Determination for the New Boston Garden Development[1] which requests: a description of the architectural and engineering elements of the existing Boston Garden/North Station building; a discussion of the social, political, and entertainment significance of the building; and photographic documentation of the existing building as well as original plans and historic views. This section also responds to comments from the Massachusetts Historical Commission (MHC)[2] which requests that this Draft EIR/PIR consider impacts to the Bulfinch Triangle Historic District, the Charles River Basin Historic District, and the North Washington Street Bridge.

Due to the substantial amount of information that is necessary to fully respond to the BRA's and MHC's requirements, a separate Historic Resources Component appendix, accompanies this submission. The contents of this appendix include:

- An overview of the history of the project site and its setting and a description of the history of the development of Boston Garden/North Station building

- Lists of key social, political, and entertainment events in the history of Boston Garden

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1/ Boston Redevelopment Authority - Scoping Determination; New Boston Garden Development, August 18, 1989, as modified.

2/ Massachusetts Historical Commission; Letter dated May 24, 1989.

- Photographic copies of some of the original plans for the Boston Garden/North Station building
- Photographic copies of architectural and engineering details of the building
- Photographic copies of historic views of the building and the vicinity
- "A History of Boston Garden - A Diamond Jubilee (1928 - 1988)" which commemorates the social and entertainment history of Boston Garden[3]
- A photographic record of the exterior and interior of the existing building according to Historic American Building Survey (HABS) standards

HISTORIC DEVELOPMENT AND SETTING

The site of the Boston Garden/North Station was originally an embayment of the Charles River, which extended beyond Haymarket Square. Before the development of the city in the early 1600s, this area was under the waters of the Charles River and was known as North Cove or Mill Cove. At low tide, the tidal flat of the area was passable in the vicinity of present-day Causeway Street. By the mid-1640s, millers who had been granted water rights to North Cove had changed the shoreline by damming the cove at its mouth, thus turning the basin into a large millpond.

In 1804, the North Cove mill owners reached an agreement with the city to fill the cove. A dike was first built along the present line of Causeway Street, completely cutting off this portion of the river. Around 1830, the project area was filled by means of the partial leveling of Beacon, Cotton (Pemberton), and Copps hills. The area south of the project site was initially filled in the early 1800s and is characterized by a triangular street pattern laid out by Charles Bulfinch.

The project site was developed first as a commercial waterfront and shortly thereafter as a rail terminus for several railroads. The Boston & Lowell Railroad opened for travel in 1835 with its Boston terminus just south of Causeway Street. The Boston & Maine Railroad originally extended into Haymarket Square, despite a city ordinance which forbade locomotives from crossing Causeway Street.

By the 1850s, four northern rail lines--Boston & Maine Railroad, Fitchburg Railroad, Eastern Railroad, and Boston & Lowell Railroad--terminated at or near Causeway Street, each with its own passenger and freight depot. These four railroad lines were located on the site of the existing Boston Garden. In the late 1880s, plans were made to consolidate the railroad facilities, and construction of the new Union Station was completed in 1889. The Union Station facility originally consisted of three brick structures located together on the north side of Causeway Street, allowing access through individual connections to one main train concourse. The facade and concourse of Union Station, designed by the architects Sheply, Rutan, and Coolidge, was a large neo-Romanesque arch fronting on the north side of Causeway Street.

3/ Francis J. Connolly, "A History of Boston Garden - A Diamond Jubilee 1928 - 1988;" Boston Phoenix (1988).

Near the turn of the century, Union Station was the largest railroad station in the United States and served roughly 500 trains a day. By the early 1920s, however, the facilities, operated as a unit by the Boston & Maine Railroad, were not adequate to serve the large daily passenger load.[4] The Boston & Maine Railroad had a stated policy of providing Boston and New England with the best possible transportation facilities.[5] The condition of Union Station and its associated railroad facilities, along with increasing demands for rail transportation, created the need for a new facility. Union Station and the depots behind it were demolished in 1927 to make way for the existing Boston Garden/North Station building.

The Boston Garden/North Station area has long been the focus of local and out-of-town travel. In the late 1800s, in order to alleviate street congestion, an elevated track was built in the vicinity of the site, replacing the street trolleys. The elevated trolley track, which was part of a citywide transit system, was originally located between Canal Street and Haverhill Street, and split off in easterly and westerly directions along Causeway Street. Much later, in the 1950s, with the building of the John Fitzgerald Expressway (Central Artery), this configuration was modified so that the elevated tracks extended only west along Causeway Street from just east of the intersection of Causeway Street and Canal Street. This line is currently part of the Massachusetts Bay Transportation Authority (MBTA) Green Line rapid transit route which runs from downtown Boston to Lechmere Station in Cambridge. The elevated structure is scheduled to be removed in 1996 once the new MBTA Green Line tunnel is completed.

EXISTING BUILDINGS

The existing Boston Garden/North Station building was constructed in 1927 and 1928 to replace the outdated and inefficient railroad facilities of Union Station. The development included a new arena (coliseum) which was built above the new North Station terminal. The building, including both the train station and the arena, was owned by the Boston & Maine Railroad. The marketing of the arena portion of the project was the responsibility of Tex Rickard, a New York boxing promoter and developer of New York Madison Square Garden. Tex Rickard is attributed with developing the concept of building the arena over the air rights of the railway line. After Mr. Rickard's death only two months after the Boston Madison Square Garden's opening, the Boston Madison Square Garden Corporation took over responsibility of promoting arena events.

North Station was formally opened on November 14, 1928, in a ceremony attended by President Calvin Coolidge. Train facilities occupied the ground floor and mezzanine. These facilities were designed to accommodate approximately 80,000 passengers per day. The Boston Madison Square Garden arena hosted its first event on November 17, 1928, and seated between 14,000 and 18,000 people. It was reported to be the largest arena in the United States at the time. After Tex Rickard died in 1929, the Boston Madison Square Garden Corporation held a competition to rename the building. Since that time it has been known as

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4/ "Old North Station at Boston Replaced by a Modern Structure Including a Coliseum"; Engineering News Record (February 28, 1929).

5/ "B. & M. Opens First Unit of New Passenger Station at Boston"; Railway Age (August 25, 1928).

Boston Garden. Boston Garden has been the home of the Boston Bruins ice hockey team since its opening. In 1946, the newly formed Boston Celtics basketball team also made Boston Garden its home.

The Garden/North Station building was owned by the Boston & Maine Railroad until December 29, 1965, when it was sold to Linnel and Cox, trustees for the 120 Trust. On May 25, 1973, New Boston Garden Corporation purchased the building. At the time of this purchase, New Boston Garden Corporation was a subsidiary of Storer Broadcasting. Delaware North acquired New Boston Garden Corporation in October 1975.

Building Design and Original Construction

Boston Garden was designed by Funk and Wilcox Co. of Boston, and the North Station facilities and building facade were designed by Fellheimer and Wagner Co. of New York. The building is one of approximately forty Art Deco buildings and storefronts built in Boston between 1926 and 1950, and was constructed at the height of a citywide building boom.

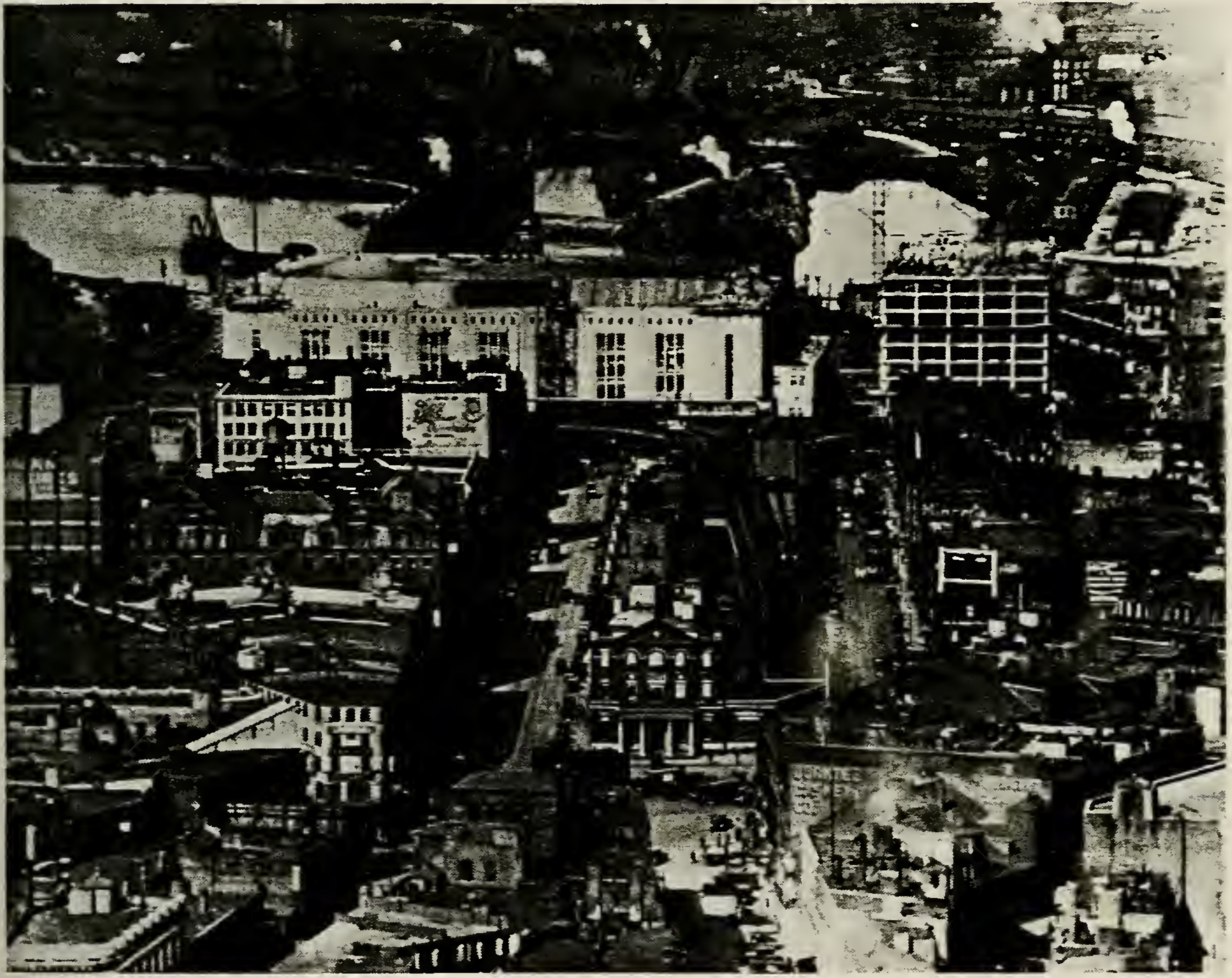
At the time it was built, the Boston Garden/North Station building was unique in using air rights above a train station for the construction of an arena.[6] It was part of a larger development project which also involved the widening of Causeway Street, the construction of the adjacent North Station Industrial Building (Anelex Building), and the construction of the now-demolished Hotel Manger (Madison Hotel). Figure IV-E-1 shows a photograph of the building under construction in 1928.

The six-story Boston Garden/North Station building consisted of the passenger terminal area and the arena located above the terminal area. The arena was connected to the station by wide exit ramps at the east and west ends, which provided connection for the public between the elevated railway station on Causeway Street, the arena floor level, and the station floor level. Figures IV-E-2 and IV-E-3 show various elevations of the building, and Figure IV-E-4 shows a section through the original arena and train station.[7]

The building had a frontage of 440 feet on Causeway Street. The trains were originally located approximately 170 feet north of the curb line of the street. The waiting room and concourse were located between Causeway Street and the train platform. The train station area originally included a mezzanine level with additional waiting areas and stores. The arena, built above the train concourse, had an overall west-east dimension of 360 feet with a depth of 205 feet. It extended over the train area about 35 feet beyond the train gates. A three-story building along Haverhill Street (a portion of which is now called Accolon Way) was designed to accommodate baggage space on the ground floor, (see Figure IV-E-5). This building was later demolished, and the site is currently used by the Massachusetts Bay Transportation Authority (MBTA).

6/ Building Information Form, Area - CBD, 84-118 Causeway Street - North Station and Boston Garden; Boston Landmarks Commission.

7/ "B. & M. Opens First Unit of New Passenger Station at Boston"; Railway Age (August 25, 1928).

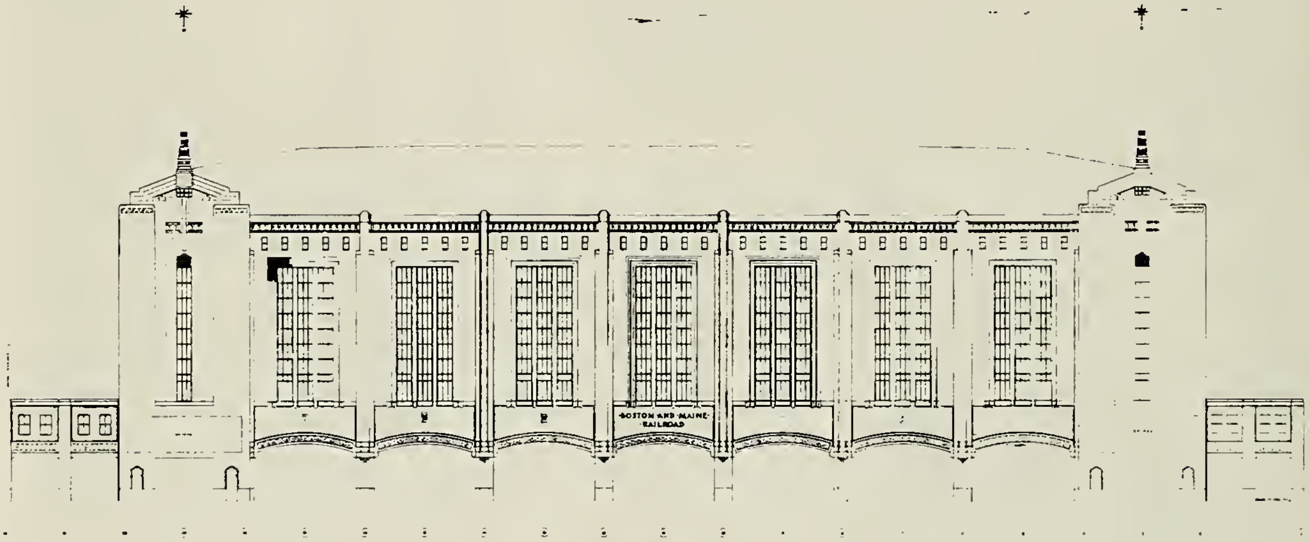


Photograph Courtesy of the Massachusetts Historical Society.

Vanasse Hangen Brustlin, Inc.

Boston Madison Square Garden
Under construction 1928
Aerial view looking North

Figure IV-E-1

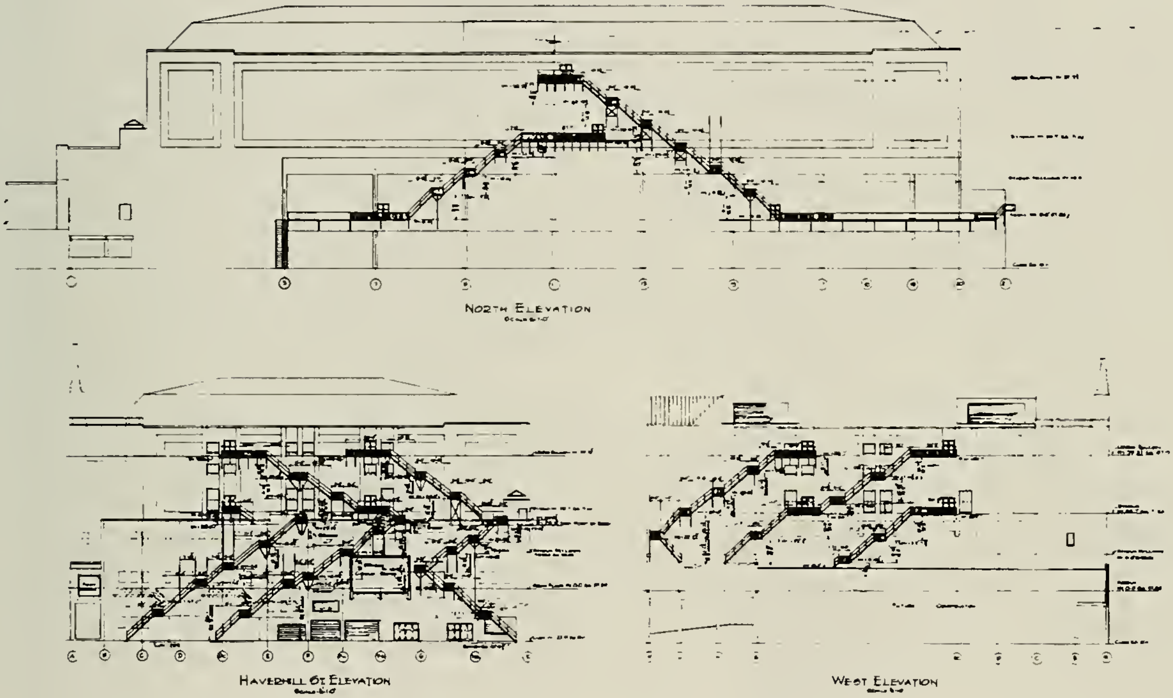


Source: Original Plans, Funk and Wilcox Company/
Fellheimer and Wagner, Associates

Vanasse Hangen Brustlin, Inc.

Boston Garden/
North Station
Causeway Street
Elevation, 1928

Figure IV-E-2

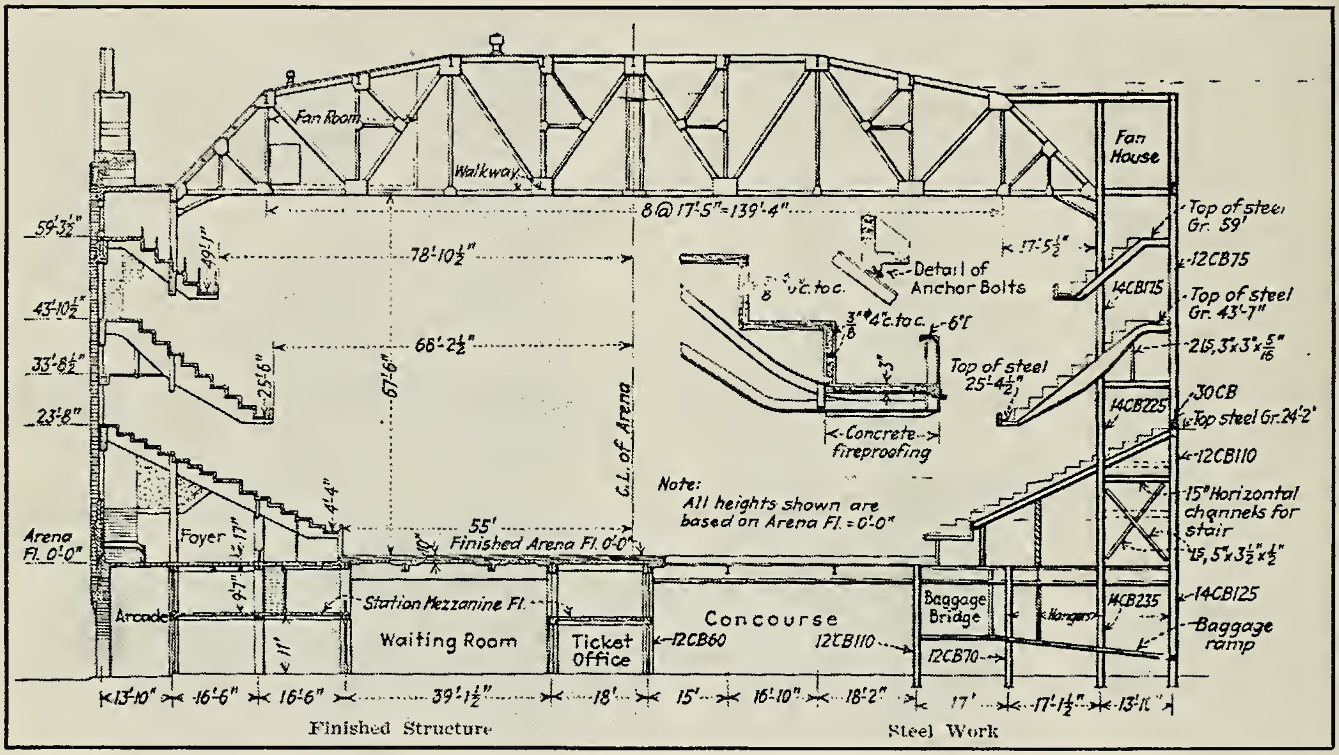


Source: Original Plans, Funk and Wilcox Company/
Fellheimer and Wagner, Associates

Vanasse Hangen Brustlin, Inc.

Boston Garden
Elevations, 1928

Figure IV-E-3

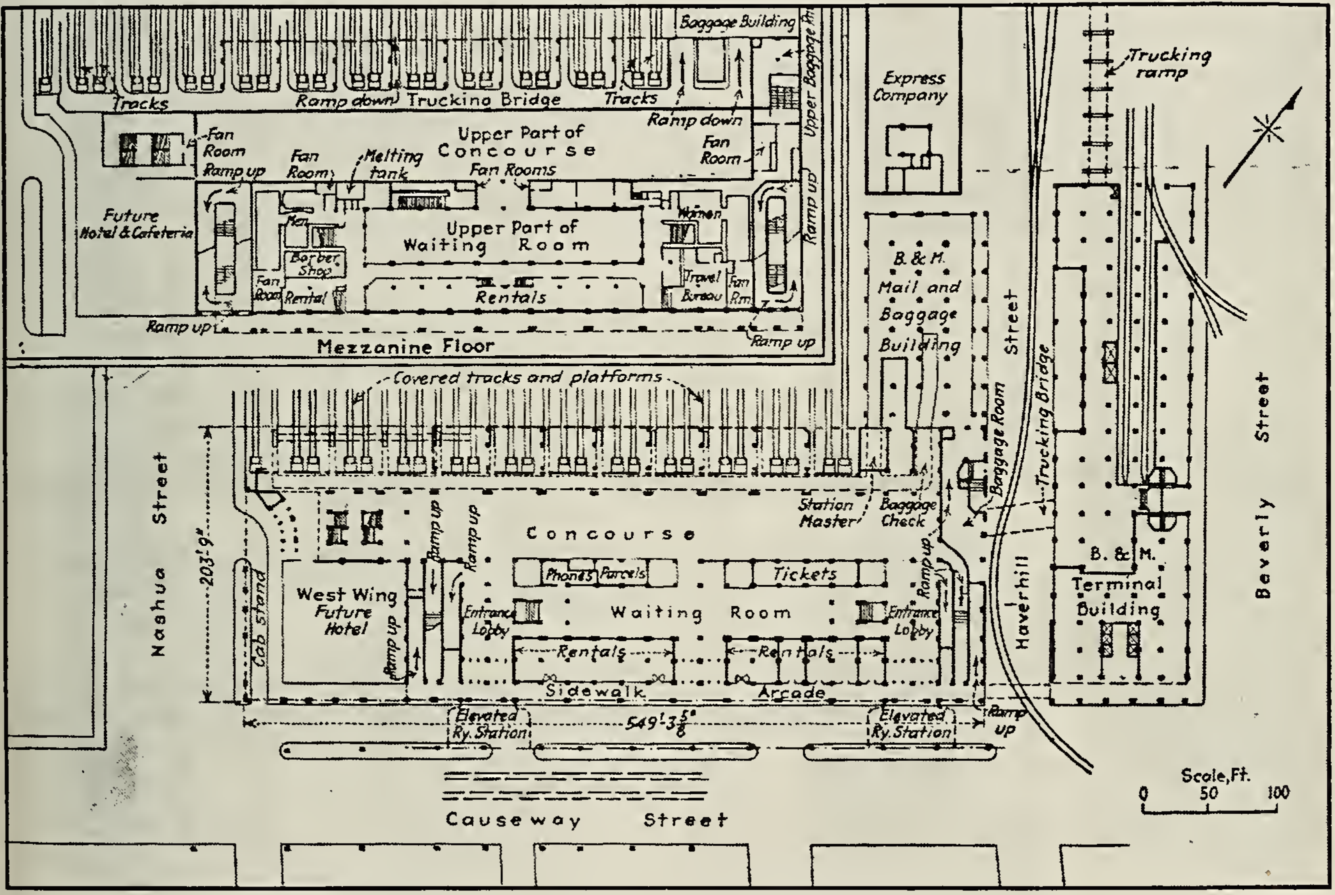


Source: Engineering-News Record, February 28, 1929

Vanasse Hangen Brustlin, Inc.

Existing Boston Garden/
North Station
Section Through Arena
and Station

Figure IV-E-4



Source: Engineering-News Record, February 28, 1929

Vanasse Hangen Brustlin, Inc.

Existing Boston Garden/
North Station
Ground Floor and
Mezzanine Plan

Figure IV-E-5

The train waiting room was approximately 40 feet in width and 260 feet in length, and the concourse was 60 feet in width and 440 feet in length. Station facilities on the ground floor included the train announcement boards, ticket offices, an information bureau, Western Union Telegraph Co., parcel and baggage check rooms, exhibit spaces, and various stores and rental areas. The mezzanine included offices, waiting areas, restrooms, and small stores.

The arena above the railroad station originally had a seating capacity of approximately 18,000 for boxing events and 14,500 for hockey (basketball was not introduced until the 1940s). The main arena floor was 100 feet wide and 245 feet in length, and could be converted to an ice surface for hockey or to a wooden floor for other events. The seats were arranged around the arena in stadium (oval) form, with one large balcony extending completely around the building, and an upper balcony along each side of the building. Stairways were located at each corner of the arena to provide access and egress for events as well as emergency egress.

The foundation for the building required considerable excavation of wood piles and granite blocks originally used in the construction of the former Union Station. The building was supported on concrete piles (see Figure IV-E-6), and the station and arena were both supported by structural steel. The station steel was erected first, and the concrete arena floor was then put in place. This served as a working floor for the erection of the arena. A system of roof trusses and crossbeams was used for the roof.

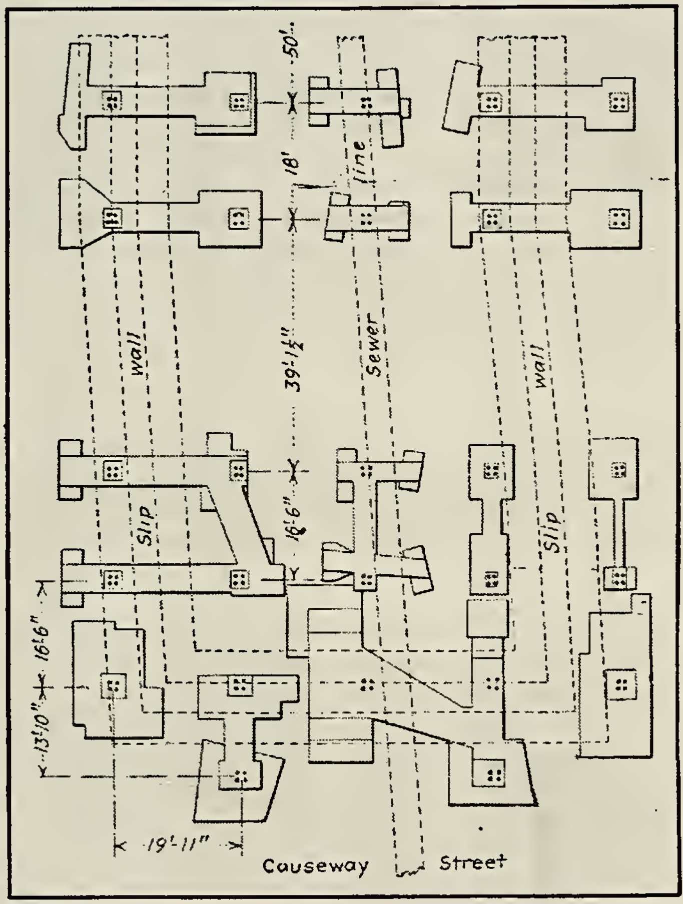
The exterior finish of the building was buff face brick arranged in strong vertical patterns. The interior of the station was finished with terrazzo floors, marble wainscot, and tinted and textured California stucco walls and ceilings. The arena lobbies and foyers had terrazzo floors with plastered walls. The remainder of the interior was surfaced with terra cotta tile. Stairs, corridors, and concrete seat steppings were all given a plain concrete finish. The roof trusses were painted aluminum color, the walls and facias light buff, and the wooden chairs olive green.

Heating and ventilation for the station and the arena were constructed as separate systems. The station had large fans at each end of the concourse and waiting room. The arena heating system was designed to meet the variable conditions required for different events. Five large fresh air supply fans and eight exhaust fans were located at the roof level. All of the air used for ventilation was filtered through oil-flushed filters and then passed through heating stacks.

The arena floor was equipped with a brine-piping system to provide an ice floor surface for ice hockey and other events. The ice floor required 13 miles of 1-1/4-inch piping embedded in special concrete. An amplifier, which hung from the roof trusses in the center of the building, was installed at the time of construction. The amplifier could be operated from the ringside, the balconies, or the engineer's room.

Renovations, Repairs, and Improvements

Since the construction of the Boston Garden/North Station in 1928, the building has undergone significant alterations. For example, the building's facade is severely deteriorated and requires constant on-going maintenance to protect



Source: Engineering-News Record, February 28, 1929

Vanasse Hangen Brustlin, Inc.

Existing Boston Garden/
North Station
Portion of Foundation

Figure IV-E-6

public safety as well as general maintenance to the building. The arena facilities, in particular, have been upgraded to accommodate additional sports and cultural events, including improvements to seating, systems, and other features. These changes are described below.

Seating

The seating arrangements and number of seats in Boston Garden have been changed several times over the last sixty years. The original box seats in the arena have been converted to more functional and flexible seating, and the stadium concept of seating design of the original building is no longer in place. The most significant change was the installation of thirty-six sky boxes on the northern and southern sides of the arena. Built in the 1970s and 1980s, these boxes provide more spacious seating facilities. In 1982, the seating configuration was changed to provide additional seating in the mid-level section of the arena. All of the seating changes which have been implemented have made the seating plan more functional for users. There are currently approximately 14,420 seats for hockey, 14,890 seats for basketball games, and 15,000 seats for center stage or boxing events.

Building Systems

- The original ventilation system is still in place despite operational problems associated with reconfiguration of the seating. There is no air conditioning system.

- In the mid-1980's when a restaurant and club were constructed, various changes were made to the building's heating system, including the installation of five cooling towers.

- In the 1980s, the Boston & Maine Railroad, which originally provided electrical and steam service to the Garden, ceased operations. Boston Edison then provided electrical service, and an additional electrical feed was installed to provide back-up facilities. Over the years, fuses have been replaced with circuit breakers, and other maintenance procedures have been instituted. Instead of steam, heating of Boston Garden is currently by oil burners. A 10,200 gallon fuel oil storage tank was installed, surrounded by a concrete dam in an area behind the boiler room.

- The building's sound system has been improved, including the installation of additional speakers in the upper reaches of the arena and installation of cones in the catwalk areas to improve sound clarity.

Floor

A removable parquet floor, constructed of interlocking panels, replaced the original floor and was installed in Boston Garden to allow hockey and basketball games to be played on alternate days. The parquet floor is laid directly over the ice, which reduces the time necessary to change the floor to a different surface. The current parquet floor is twenty-eight years old and requires continual maintenance and repair.

Ice Surface

In 1969, the original brine-based ice surface was replaced with a freon-based system, and the refrigeration system was upgraded at the same time.

Other Facilities

Various other facilities have been added to the building including:

- A restaurant and club (Blades and Boards) was constructed in the North Station building in the mid-1980s to provide additional facilities for sports patrons and sky box owners. The Boston Madison Square Garden Club which provides tickets and other facilities to members is also located in the building, in space leased from New Boston Garden Corporation.

- A modern scoreboard, which allowed greater visibility of scores and more rapid response time, was installed in the 1970s.

- Improvements to the locker room facilities have been limited to replacement of fixtures.

- Two walkways passing over Accolon Way were constructed between the Boston Garden/North Station building and the Anelex building. These walkways were built to facilitate management and servicing of Boston Garden from the Anelex building.

Roof

A new roof, consisting of a Carlisle system of rubber sheeting built over the original roof, was installed during the 1983-84 season. The new roof provides improved insulation and weather protection.

Railroad Facilities

In the 1940s, a number of the train tracks were eliminated, the platforms were moved north toward the Charles River, and a parking lot was constructed in the area behind the North Station building. A covered walkway was constructed between the building and the platforms. Currently there is little remaining evidence of the original train waiting room fixtures and features. The wooden benches and stores have been removed, and the tiles and marble areas have been replaced. Access from the trains into the train concourse and out onto Causeway Street is extremely constricted, especially when crowds are present for arena events. The train station is currently very unattractive, and it operates below the standards for which it was designed in the 1920s. Due to a number of factors, train operations have been reduced over the years, and the number of tracks has also decreased. There are also limited retail and support facilities available to commuter rail passengers.

The MBTA projects involving commuter rail improvements, Green Line improvements, and construction of the superplatform, along with the New Boston Garden Development including the Public Concourse, will modernize the train facilities. These improvements are necessary to expand capacity in response to growing public demand for commuter rail and rapid transit service, and are anticipated to provide adequate train services into the twenty-first century.

Physical Status of the Existing Boston Garden/North Station Building

Despite the changes and improvements described above, the Boston Garden building is deteriorating rapidly. Of particular concern are the mechanical systems serving the building. Although recent upgrades have been implemented, the electrical system is unreliable; in the last few years there have been interruptions in electrical service during sporting events and other activities. There is no air conditioning system serving the arena, which is a particular problem during the summer. Major events are rarely scheduled during the warm months of the year. The facade of the building is severely deteriorated and requires constant maintenance. The service and truck access to the facility is antiquated, and this limits the functioning of the building and use for concerts and other entertainment events. Views are obstructed in certain locations, and the sound system requires improvement. The inflexibility of the original design of the building, coupled with the general inadequacy of the facility, makes it difficult to compete with more modern arenas in the region, such as the Worcester Centrum and the Providence Civic Center.

The train facility can no longer adequately accommodate the commuter rail traffic required to serve the commuter routes north of the city. The waiting room area is, at best, inadequate, with limited places for seating, no space for lockers for commuters, and unsatisfactory access and egress to and from the trains.

Social and Cultural Importance of Boston Garden.

Boston Garden has been an important venue for cultural and social events associated with the history of Boston. Originally built to be used for boxing, ice hockey, ice shows, and concerts, Boston Garden has hosted basketball games, tennis and soccer matches, political rallies, circuses, and religious gatherings. Boston Garden is the home of the Boston Bruins hockey team and the Boston Celtics basketball team.

The first sporting event at Boston Garden was a boxing match between Andre Routis of France and Dick "Honey-Boy" Finnegan of Dorchester. The Boston Bruins' first Stanley Cup was won in Boston Garden in 1929. During the 1930s, boxing, hockey, and public skating were the main attractions at Boston Garden. Other sporting activities held at Boston Garden during that time included tennis, indoor baseball, and football. In 1946, the Boston Celtics basketball team played its first game in Boston Garden, against the Toronto Huskies, and in the 1950-51 season, the team became part of the professional basketball association through the efforts of Arnold "Red" Auerbach.

Many important political events and rallies have been held in the Garden, including: James Michael Curley's rally for his gubernatorial campaign in 1938; Franklin D. Roosevelt's presidential campaign rally in 1940 (the rally drew a crowd of 25,000 people); New York governor Thomas E. Dewey's presidential campaign speech in 1944; General Dwight Eisenhower's election eve rally in 1952; Winston Churchill's presentation at the Massachusetts Institute of Technology's Mid-Century Convocation in 1949; and John F. Kennedy's homecoming rally on election eve in 1960.[8]

Concerts, circuses, and appearances by musicians and entertainers at Boston Garden have included: the Ringling Brothers, Barnum and Bailey Circus (1929 to the present); big bands in the late 1930s and 1940s; Milton Berle and Bob Hope in 1949; Duke Ellington in 1951; Judy Garland in 1961; the Beatles in 1964; Elvis Presley in 1971; the Rolling Stones in 1975; Bruce Springsteen in 1980; and many others. Famous ice shows at Boston Garden have included: ice skating champion Sonja Henie's debut in 1936; the Ice Follies in 1937; the first Ice Capades in 1940; Peggy Fleming and the Ice Follies in 1969; and the first Disney's World on Ice in 1982.

Boston Garden has also been the location of many religious events. The evangelist Ronald Smith appeared in Boston Garden in 1929, Bishop Fulton Sheen appeared in 1953, and Jimmy Swaggart held his religious crusade in the Garden in 1983. The Garden is currently used approximately forty times a year by the Boston Church of Christ for services and meetings.

Additional documentation of the social, cultural, political, and entertainment history of Boston Garden is provided in an Historic Resources Component appendix. A list of key events held in the building over the last sixty-two years is presented, along with material commemorating the sixtieth anniversary of Boston Garden.

HISTORIC STATUS OF BOSTON GARDEN/NORTH STATION

There are three levels of historical protection or status which can be bestowed on historic properties: listing on the National Register of Historic Places; listing on the State Register of Historic Places; and designation as a Boston (local) Landmark.

In the 1980 Central Business District Preservation Study, Boston Garden/North Station was recommended for individual listing on the National Register of Historic places by the Boston Landmarks Commission (BLC). The BLC described the building as "an early example of an Art Deco Style structure which survives largely intact and continues to serve its original purpose as a railroad terminal and coliseum".[9]

At the time of evaluation by the BLC, the building had undergone substantial modification and repair as described in the section on renovations and improvements. However, in 1983, the Massachusetts Historical Commission found the Boston Garden/North Station building to be ineligible for National Register listing or protection as an historic resource on the State Register of Historic Places.[10] This was due to the further renovations and improvements

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8/ "A History of the Boston Garden: A Diamond Jubilee 1928 - 1988"; Francis J. Connolly, Boston Phoenix (1988).

9/ "Central Business District Preservation Survey Draft Summary of Findings"; Boston Landmarks Commission (1980).

10/ North Station Urban Renewal Project Final EIR (November 30 1983).

made to the building which have compromised its historic integrity. Thus the building is not eligible for protection as an historical resource neither under Massachusetts Historical Commission's nor the Boston Landmarks Commission's purview.

According to Massachusetts Historical Commission records, the archaeological significance of the site is minimal. As described earlier, the site is built on fill; as a result of the filling in the early 1800s, it is unlikely that there would be significant undisturbed archaeological remains predating 1835 in the area.[11]

HISTORIC RESOURCES IN THE PROJECT AREA

Near the Boston Garden/North Station building there are two historic districts, the Bulfinch Triangle Historic District and the Charles River Basin Historic District, both of which are listed on the National Register of Historic Places and the State Register of Historic Places. In addition, the North Washington Street Bridge over the Charles River has been determined eligible for inclusion on the National Register of Historic Places by the Massachusetts Historical Commission in consensus with the Federal Highway Administration. The U.S.S. Constitution, berthed in the historic Charlestown Navy Yard, is located northeast of the project site. Figure IV-E-7 shows the location of historic resources in the vicinity of the New Boston Garden Development.

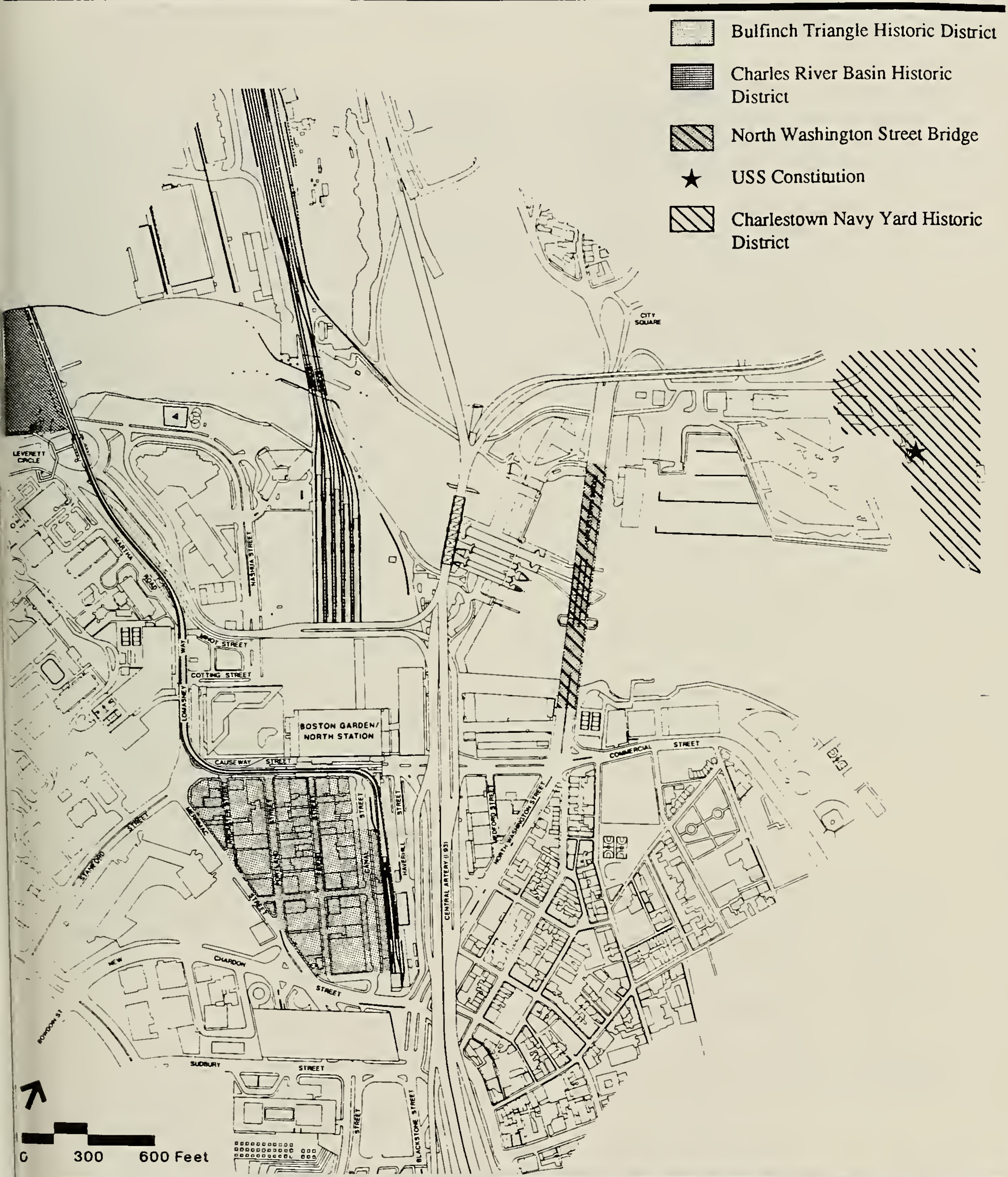
Bulfinch Triangle Historic District

The Bulfinch Triangle Historic District, listed on the National Register of Historic Places in February 1986, is located in the northern portion of downtown Boston, opposite the Boston Garden/North Station and adjacent to the North End and Government Center sections of the city. In the early 1800s, Charles Bulfinch developed a plan for a new 50-acre area created through filling of the North Cove of the Charles River.[12] The District, presently comprised of fifty-nine structures, encompasses the western half of the triangular street pattern planned by Bulfinch, and includes structures on Canal, Causeway, Friend, Lancaster, Merrimac, Portland, and Traverse streets. The District, shown in Figure IV-E-7, occupies an area of approximately 7 acres and is characterized by a large number of late nineteenth-century and early twentieth-century commercial buildings.

The Bulfinch Triangle Historic District is composed of narrow blocks of north/south-oriented streets, with buildings predominantly five to six stories in height. The proximity of the area to western and northern railroad lines encouraged the development of the District in the 1870s and 1880s, and the District has a large number of well-preserved, architecturally-distinguished buildings.

11/ Bulfinch Triangle Historic District, Boston, Massachusetts; National Register of Historic Places Inventory - Nomination Form; no date.

12/ Bulfinch Triangle Historic District, Boston, Massachusetts; National Register of Historic Places Inventory - Nomination Form.



Vanasse Hangen Brustlin, Inc.

Historic Resources in the Project Area

Figure IV-E-7

The commercial buildings in the district are characterized by masonry construction in Second Empire, Romanesque Revival, and Beaux Art styles. Of the fifty-nine structures in the district, only thirteen buildings have been classified as non-contributing. This is due mainly to age or alteration, rather than intrusion of use or scale. Key buildings in the district include:

- 123-125 Merrimac Street, which is the only structure from the mid-nineteenth century that has retained much of its original appearance

- 48-72 Canal Street, which was the original location of the Paine Furniture Company

- The Lockhart Building (137-149 Merrimac Street), the H. Hollis Hunnewell Building (91-97 Causeway Street), and the Peter Brigham Building (176-192 Portland Street), which were constructed in the 1880s to respond to the commercial and manufacturing needs created by the railroads

The district is closely tied to Boston's furniture manufacturing and wholesale business of the late nineteenth century. After the 1920s, the district lost popularity as a major center of the furniture trade, due in part to the transformation of North Station into a commuter rather than a freight facility and the general decline of the furniture manufacturing industry in Boston.

The integrity of the original Bulfinch Triangle was disrupted with the construction of the elevated John Fitzgerald Expressway (Central Artery) and the Government Center garage. These two projects impacted the district's eastern edge and southern tip and have severed the area from Boston's downtown. The area north of Causeway Street opposite the Bulfinch Triangle has always been the site of railroad-related buildings and hotels, including various large buildings such as Union Station and the depots it replaced.

In 1983, the Madison Hotel (built at the same time as the existing Boston Garden/North Station) was imploded, and a federal office building (US General Services Administration Building) was constructed on Causeway Street. As described above, the Boston Garden/North Station building replaced the old Union Station in the late 1920s. Recently, in response to market demands from financial and office tenants, considerable renovation and in-fill development has occurred in the Bulfinch Triangle area.

Charles River Basin Historic District

The Charles River Basin is an important element in Boston's metropolitan park system, the first such system implemented in the United States. The embankment and parkland adjoining the Charles River provide residents of the greater Boston area with recreational and outdoor opportunities. Established in the nineteenth century, the district includes the Charles River Basin and both banks of the Charles River from the Charles River Dam upstream of the Eliot Bridge. The completion of the Charles River Dam in 1910 converted these once tidal mud flats into a recreational area that is a focal point of Boston's park system today.[13] The area and facilities are managed by the Metropolitan District Commission.

13/ Charles River Basin Historic District; National Register of Historic Place Inventory - Nomination Form; no date.

In total there are eight bridges, two canals, two parkways, six boat houses, and eight other structures as well as the parkland on both sides of the River which comprise the District. Individual elements of the Charles River Basin Historic District within 3,000 feet of the New Boston Garden Development include:

- The Charles River Dam. The dam was constructed between 1903 and 1910, and up until 1978, this dam controlled the water level of the Charles River Basin by excluding harbor tides. A new dam was built in 1978, and it provides additional, more reliable flood and level control of the river. Adjacent to the "old" Charles River dam on its eastern downstream side is a monumental viaduct built in 1910 to carry the street cars of the Boston elevated railway. This viaduct is still used for the MBTA's Green Line.

- The Longfellow Bridge. The bridge (originally known as the Cambridge Bridge) was completed in 1906 and is used for the MBTA Red Line and four lanes of traffic. The bridge has elevated steel arch supports on masonry piers and two abutments flank the center arch.

- The Museum of Science and Hayden Planetarium. In 1951, the Museum of Science was built on the grounds of the Old Charles River Dam and on adjacent areas of additional fill.

- The Lechmere Canal. Constructed in 1909, the canal connected the commercial and warehousing operations in East Cambridge with the Charles River.

Other elements of note include: Memorial Drive and Cambridge Parkway; Embankment Road, Storrow Drive and Soldiers Field Road; the Metropolitan District Commission (MDC) Police Headquarters and Lock Houses; the MDC Boat House and Sailing Pavilion; and the Hatch Memorial Shell.

North Washington Street Bridge

According to a Massachusetts Historical Commission report on forty-four movable bridges under the purview of the Massachusetts Department of Public Works (MDPW),[14] the North Washington Street Bridge (also known as the Charlestown Bridge) over the Charles River appears to be eligible for listing on the National Register of Historic Places. The bridge was constructed between 1896 and 1899 and is a triple-barrel, double-deck, rim-bearing, trussed "swing"-type bridge. At the time of its completion, its drawspan was the widest (100 feet) in the world. Designed by Jacoby and Smith, the bridge is the best example of a simple (as opposed to continuous) swing-type bridge in existence, according to the Massachusetts Historical Commission. Although the approach spans, in particular, have been altered, the drawspan remains an important technological achievement.

The North Washington Street Bridge, connecting City Square in Charlestown with the North End and downtown Boston, provides a regional connector between areas north of the city and downtown Boston. The bridge is currently being improved as part of the Central Artery Northern Area (CANA) construction project.

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[14] National Register Evaluation of Historic Movable Bridges (1985).

U.S.S. Constitution/Charlestown Navy Yard

The U.S.S. Constitution, the oldest commissioned United States warship afloat today, is berthed in the historic Charlestown Navy Yard, approximately one-half mile northeast of the site. The frigate was launched in 1797 from Hartt's shipyard in Boston and first saw action in France. The ship gained her reputation and nickname "Old Ironsides" in battle against the British during the war of 1812, in which she sank two British frigates and captured two sloops-of-war. After the war, the Constitution made several trips to the Mediterranean, and in 1833, she became the first ship to use the new drydock at the Charlestown Navy Yard. She later served as the flagship of the American Navy. In 1954, Boston was designated as the U.S.S. Constitution's permanent home port.[15]

The Charlestown Navy Yard is listed on the National Register of Historic Places and is also a National Historic Landmark. By virtue of its National Register status, the Navy Yard is listed the State Register of Historic Places and includes a drydock, a ropewalk, a foundry, a marine railway, and is also the home port of U.S.S. Cassin Young. Charlestown Navy Yard is a unit of Boston National Historical Park, National Park Service, US Department of the Interior.

PROBABLE PROJECT IMPACTS

Boston Garden/North Station

The existing Boston Garden/North Station building will be replaced as part of the New Boston Garden Development. The building is currently inadequate to serve the needs of a modern sports arena and commuter train station, due to the age of the building with substandard facilities, systems, and access.

Although Boston Garden/North Station is ineligible for listing on the National Register of Historic Places, the Massachusetts Historical Commission requires that complete photographic documentation of the existing interior and exterior of the building be completed in accordance with the Historic American Building Survey (HABS) requirements. This documentation is included in an Historic Resources Component appendix. As noted earlier, as a result of the filling in the early 1800s, it is unlikely that there would be significant undisturbed archaeological remains predating 1835 in the area. [16]

Project Area

The existing Boston Garden/North Station is located in an area where structures have historically been larger in scale than those of the Bulfinch Triangle, and where development is characterized by a combination of old and new buildings. For example, US General Services Administration (GSA) Building is located on the site of the former Madison (Manger) Hotel which was constructed at the same time as the Boston Garden/North Station. The hotel was imploded in

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15/ U.S.S. Constitution Museum Publication -- Charlestown Navy Yard, Boston National Historical Park, National Park Service; US Department of the Interior (1989).

16/ Bulfinch Triangle Historic District, Boston, Massachusetts; National Register of Historic Places Inventory - Nomination Form; no date.

1983, and was replaced by the modernist GSA Building with its smooth angular facades of granite and glass. The Bulfinch Triangle District itself is undergoing renovation and transformation, as evidenced by the construction of 101 Merrimac Street and renovations to Portland Place, 151 Merrimac Street 175 Portland Street, and 90 Canal Street.

The New Boston Garden Development has been designed to minimize impacts to the adjacent Bulfinch Triangle Historic District. The relationship of the New Boston Garden Development to the surrounding historic districts was an important consideration in the planning and design process relating to massing, scale, and use of materials, as well as views of and from the project site. The visual quality analysis presented in Chapter IV-D depicts the effect of the project on pedestrian-level views from various locations on and off the project site.

The New Boston Garden will be located on the portion of the project site behind the existing arena. Buildings C and B and the Public Concourse will be on the site of the existing Boston Garden, fronting on Causeway Street. The building will form the northern gateway to the City, and will be highly visible to motorists travelling on the existing and subsequently depressed Central Artery. The design of the New Boston Garden and includes features which reinterpret architectural elements of the existing Boston Garden. These elements include: the lantern and spire of the north facade; subtle banding playing across the masonry surface; and vertical glass block slots which penetrate through the building on the northeast stair.

As presently conceived, the commercial component of the New Boston Garden Development is planned to link the New Boston Garden with its surroundings. Buildings B and C, connected by the Public Concourse, are intended to form a transition between the buildings on Causeway Street and the New Boston Garden. The design of Buildings B and C would be massed to create a series of stepbacks, and could echo design features of the historic Bulfinch Triangle buildings. Building A, located behind the GSA Building, would form a transition from the modern GSA Building to the New Boston Garden.

Impacts to historic resources in the area are expected to be minimal. No impacts are anticipated for the Charles River Basin Historic District other than limited amounts of shadow passing over the area during certain times of the year. The U.S.S. Constitution may also experience some small shadow effects for a few minutes a day during the late afternoon in winter (see Chapter IV-H, Shadow).

Transportation impacts to the area are described in Chapter IV-A in greater detail. Specific attention is paid to traffic impacts along Causeway Street and surrounding public ways. Impact includes changes in level of service, parking, and access. A detailed traffic mitigation plan for the whole study area is proposed.

The Massachusetts Historical Commission specifically requested consideration of the North Washington Street Bridge. Based on volumes estimated for the traffic impact analysis of this study, limited additional peak hour traffic impacts are anticipated for the Bridge. Based on volume and capacity analyses, the bridge is at or just over capacity based on existing conditions. The Causeway Street and North Washington Street intersection has a level-of-service (LOS) of E for both morning and evening peaks. Intersections that operate a LOS E during one or both of the peak hours are considered to be deficient.

Project-related traffic impacts on North Washington Street Bridge for both 1995 and 2000 are minimal. Based on the assumption that the improvements to City Square have been completed, that the Nashua Street improvements have been implemented, and that Leverett Circle becomes the route of choice, traffic volumes are projected to decrease, and overall traffic conditions are likely to improve in both 1995 and 2000 for the North Washington Street Bridge.

Short-term impacts on historic resources during construction, such as noise, dust, and possible changes to groundwater levels, will be avoided through the implementation of numerous mitigation measures (see Chapters IV-A, IV-O, and V, and below).

MITIGATION MEASURES

The design of the New Boston Garden Development was developed with careful consideration of the adjacent historic districts, and has incorporated design features intended to mitigate probable impacts of the new construction on the area. The commercial component of the New Boston Garden Development is still in the conceptual phases of planning and will become more defined as the project progresses. As presently conceived, the following measures have or will be incorporated into the project design and development process in order to minimize any adverse effects upon historic resources:

- An initial design that respects the adjacent historic districts by utilizing massing forms that respond to the design of the buildings in the Bulfinch Triangle District. This includes the massing of the bases of Buildings B and C to generally correspond to the heights of those buildings across Causeway Street. Buildings B and C are proposed to step back to the taller configurations of the towers. Pedestrian arcades are planned to line the base of Buildings B and C and are planned to be linked by the entrance to the Public Concourse. These pedestrian arcades would provide a humanscale transition to the project site.

- The conceptual designs for the buildings are intended to reflect the architectural diversity found in the adjacent historic districts. As the buildings in the Bulfinch Triangle district are characterized by a mixture of styles, scale, and detailing, so may the deign of Buildings A, B, and C reflect a variety of massing configurations, building materials, and heights.

- The New Boston Garden will have a dark rough hewn masonry facade with striking patterns and signage and includes a long-span roof. The northern approach of the Central Artery's Commuter rail lines, combined with the prominent exposure of the buildings from the north, establishes the New Boston Garden as a gateway structure. In response, the building has been designed as an asymmetrical composition focusing on the northeast corner. An illuminated tower located there will serve as a beacon from a distance and will also be the most prominent element seen from the elevated Central Artery before entering the depressed Artery.

- The design of the commercial component is intended to retain and even enhance the pedestrian flows in the area. The Canal Street corridor, which currently serves as the major pedestrian route for commuters and the spine of the Bulfinch Triangle District, forms the primary pedestrian entrance point to the proposed Public Concourse. The entrance to the Public Concourse is planned to be directly opposite the intersection of Causeway and Canal Streets. In addition, the location of the cross-platform in the train shed area below the New Boston Garden has been designed to line up with existing diagonal pedestrian movements through the GSA Building. The arcade along Causeway Street is scaled to handle large crowds, moving laterally along the building so as to protect pedestrians from the elements.

- A traffic mitigation plan, described in Chapter IV-A, has been conceived to minimize traffic-related impacts for the entire study area, including the Bulfinch Triangle, North Washington Street Bridge area, and the other historic resources in the area. A traffic management plan will be prepared to addressing construction-related traffic impacts. Consideration will be given to maintain traffic flow, address the deliveries and use of equipment and protection of pedestrian access routes.

- A construction monitoring and mitigation plan, outlined in Chapter IV-N, will provide protection for people and buildings in the area from the effects of noise and dust.

- As part of this Draft EIR/PIR, documentation on the existing Boston Garden is being provided to the Massachusetts Historical Commission, the State Archives, the Boston Landmarks Commission, and the New England Sports Museum.

The mitigation measures described above will limit the short- and long-term impacts of the New Boston Garden Development on the historic resources in the vicinity of the site.

F

Tidelands and Public Purpose

INTRODUCTION

Development activity in certain filled tidelands of the Commonwealth is regulated by the Department of Environmental Protection (DEP), Division of Wetlands and Waterways Regulation. The term "tidelands" is defined under Chapter 91 to include both present and former submerged lands below the high water mark. This authority, granted by Chapter 91 of the Massachusetts General Law, is intended to preserve and protect certain rights of the public in these areas. The New Boston Garden Development is located on land which constitutes filled tidelands, which are considered to be landlocked. The following section demonstrates that, because of its location, the New Boston Garden Development does not require a Chapter 91 license, but that the proponent has designed the project to satisfy the DEP criteria that would otherwise apply.

CHAPTER 91 REQUIREMENTS

Chapter 91 of the Massachusetts General Laws (MGL) authorizes the DEP to issue licenses for the filling of tidelands and for the construction of structures in tidelands. Predecessor statutes to MGL Chapter 91 dating back to 1866 also authorized the issuance of licenses for filling tidelands and erecting structures thereon, and prior to 1866, the filling and construction of structures in tidelands was authorized pursuant to specific legislative enactments. Chapter 91 also requires that a license from DEP be obtained for any change in use or structural alteration of a licensed structure or fill in or on tidelands. Under Chapter 91 and DEP's implementing regulations, DEP is authorized to license structures and fill on both private tidelands and commonwealth tidelands. This is subject to the provision that no structure or fill for a nonwater-dependent use of tidelands may be licensed unless DEP determines that: 1) the structure or fill serves a proper public purpose; 2) the purpose provides a greater public benefit than public detriment to the rights of the public in the tidelands; and 3) if the project is in the coastal zone, the determination is consistent with Massachusetts Coastal Zone Management (MCZM) policies.

Under DEP's current administrative practice, as well as under DEP's recently promulgated Chapter 91 regulations (which are anticipated to become effective on October 4, 1990), DEP does not require a Chapter 91 license for a project on landlocked tidelands. Such lands are defined as filled tidelands that, on January 1, 1984, were entirely separated by a public way or interconnected public ways from any flowed tidelands, with the exception of filled tidelands located within 250 feet of the present high water mark or within a designated port area.

TIDELANDS STATUS

The project will be located on land which constitutes filled tidelands but which is outside the Massachusetts coastal zone. This land was filled during the early 1800s. With two minor exceptions which are described below, the project site is separated from the present shoreline by several public roads, including Nashua Street, the Central Artery, and the Central Artery ramps, and is more than 250 feet away from the shoreline. In addition, the site is not located in a designated port area as defined by the MCZM.

The Director of DEP's Division of Wetlands and Waterways Regulation issued a memorandum dated May 18, 1989, to the director of the MEPA Unit which states that, because the project site is separated from the shoreline by several public ways, the New Boston Garden Development does not require a Chapter 91 license. The memorandum also states that if changes are made in the project with respect to the proposed structures or site described in the environmental notification form, DEP must be consulted to determine whether a Chapter 91 license is required. A copy of the DEP memorandum is included in Chapter VII, MEPA and BRA Correspondence.

Subsequent to issuance of the DEP memorandum referred to above, it was determined that the project will entail the use of a small parcel of filled tidelands which is located north (shoreward) of the Central Artery ramps and is not separated from the shoreline by a public way. The parcel is owned by the Massachusetts Department of Public Works (the "MDPW parcel"), and an easement will be requested from MDPW for the use of this land. The MDPW parcel is currently used as a commercial parking lot and is proposed to be used in connection with the New Boston Garden Development for the parking of vehicles. On March 12, 1990, a request was submitted to DEP for a clarification as to the need for a Chapter 91 license for use of the MDPW parcel in connection with the project, and on May 31, 1990, DEP issued a letter confirming that a Chapter 91 license is not required for the use of the MDPW parcel as described above. Copies of the March 12, 1990 request and DEP's May 31, 1990 response are included in Chapter VII.

The project will also entail the use, pursuant to grant of an easement, of a portion of a parcel of filled tidelands owned by the Massachusetts Bay Transportation Authority (the "MBTA parcel"). This parcel is located north (shoreward) of the Central Artery ramps and is not separated from the shoreline by a public way. This land will be used for installation of a storm drain which will run from the vicinity of the project site to an outfall to be located on the edge of the Charles River above the high water mark. The new drain will convey pre-treated runoff from approximately 7.27 acres of roof and pavement which currently flows to combined sewers. This significant reduction in the amount of runoff from the project site and adjacent areas discharged to combined sewers will reduce the incidence and volume of combined sewer overflows. The total volume of flows to the Deer Island Sewage Treatment Plant will be reduced. Overall, installation of this storm drain will contribute to improved water quality in the Charles River and Boston Harbor. A storm drain currently runs through the MBTA parcel, and the installation of the new storm drain will, with the minor exception of the outfall, not result in permanent alteration, or affect the future use, of the surface of the parcel. DEP has indicated that it is not certain that a Chapter 91 license will be required for the portions of the storm drain located between the Central Artery ramps and the shoreline, and a written request for a determination on this issue was filed with DEP in September 1990. A copy of this request is included in Chapter VII, MEPA and BRA Correspondence.

PROPER PUBLIC PURPOSE

Although the project does not require a Chapter 91 license, it does satisfy the statutory licensing standards referred to above. The project will serve a proper public purpose because it entails construction of a new privately-financed, state-of-the-art multi-purpose sports and entertainment arena, a Public Concourse to serve the MBTA's commuter rail lines, and commercial development which is consistent with the City's North Station Economic Development Area plans and which will provide the City with major new tax revenues and jobs. In addition, the project will include significant areas that will be open to the public, providing access to public transportation facilities and pedestrian linkages between the North Station area and the Charles River. Moreover, these significant public benefits provided by the project far outweigh any detriments to the public's rights in tidelands. The new arena will be a unique and vitally important public facility. The Public Concourse, train waiting room, and other areas providing access to public transportation, as well as the accommodation of the MBTA's Green Line improvements in the project design and the project's parking facility, constitute significant contributions to the creation of a multi-modal transportation gateway to the city at North Station. The new multi-purpose arena, the Public Concourse, and the enhancement of transportation facilities will address stated "public accommodation" goals. Finally, the project will include significant on-site areas open to the public and will provide improved pedestrian connections on streets adjacent to the project and between neighboring areas and the filled tidelands areas along the Charles River.

CONCLUSION

The New Boston Garden Development, while located on a site which is classified as filled tidelands, will not require a Chapter 91 License, since these tidelands are separated from the present shoreline by several public roads. Two small parcels of land providing support functions to the New Boston Garden Development are located in areas classified as tidelands. One parcel proposed to be used for parking will not require a Chapter 91 license, and DEP has been requested for a determination as to whether a storm drain to be located in the other parcel will require a license.

G Wind

INTRODUCTION

A pedestrian-level wind study was conducted for the New Boston Garden Development. The objectives of this analysis were to:

- Quantitatively assess the effect that the New Boston Garden Development would have on existing and future pedestrian-level wind conditions
- Compare the predicted wind conditions with criteria outlined by the Boston Redevelopment Authority (BRA)
- Develop mitigation measures for identified problem areas, if necessary

The study was based on 1:400 scale models of the existing site and the proposed development and surroundings, tested in a boundary layer wind tunnel. Information concerning the surrounding area was based on topographical maps and aerial photographs, information supplied by the Boston Redevelopment Authority (BRA), and building information obtained from the Sanborn Map Company. Additional information concerning site characteristics was obtained during a site visit. During the course of the study, a client visit was also held with the project proponent and architects, in which the model and testing procedures were reviewed.

The results presented in this report identify the pedestrian-level wind comfort resulting from four test conditions. The wind tunnel tests identified locations subject to increased wind activity on and around the New Boston Garden Development site as a result of the various on-site and off-site development configurations. Qualitative flow visualization tests were conducted to develop mitigation measures that would result in suitable pedestrian-level wind conditions at several locations. The mitigation measures, which include canopies, trellis work, windscreens, pennants, and alterations to the podium massing of Building B, were then tested in the wind tunnel. The mitigation measures were very effective at the majority of locations, reducing mean wind speeds to levels suitable for sitting, standing, or walking, and increasing the number of locations meeting the BRA wind gust criterion.

OVERVIEW

Major buildings, especially those that protrude above their surroundings, often cause increased local wind speeds at the pedestrian level. Typically, wind speeds increase with elevation above the ground surface, and taller buildings intercept these faster winds and deflect them down to the pedestrian level. The funnelling of wind through gaps between buildings and the acceleration of wind around corners of buildings may also cause increases in wind speed. Conversely, if a building is surrounded by others of equivalent height, it may be protected from the prevailing upper-level winds, resulting in no significant changes to the local pedestrian-level wind environment. The most effective way to assess potential pedestrian-level wind impacts around a proposed new building is to conduct scale model tests in a wind tunnel.

The consideration of wind in planning outdoor activity areas is important since high winds in an area tend to deter pedestrian use. For example, winds should be light or relatively light in areas where people would be sitting, such as outdoor cafes or playgrounds. For bus stops and other locations where people would be standing, somewhat higher winds can be tolerated. For frequently used sidewalks, where people are primarily walking, stronger winds are acceptable. For infrequently used areas, the wind comfort criteria can be relaxed even further. The actual effects of wind can change from pedestrian inconvenience, due to the blowing of dust and other loose material in a moderate breeze, to severe difficulty with walking due to the wind forces on the pedestrian.

METHODOLOGY

For this analysis of pedestrian-level wind conditions, the following conditions were tested:

- 1990 Existing Conditions - includes the Green Line (elevated) and buildings under construction and completed during the preparation of this Draft EIR/PIR. These buildings include the Spaulding Hospital Extension and the new Suffolk County Jail.

- 1993 New Boston Garden Condition - includes 1990 Existing conditions plus the following: New Boston Garden, North Station Commuter rail platforms, Lowell Square (proposed), 101 Merrimac (proposed), Green Line (elevated), and Merrimac Street connector.

- 1995 Interim-Build Condition - includes 1993 New Boston Garden conditions plus the following: New Boston Garden, Building C and the Public Concourse, and the Green Line (removed).

- 2000 Full-Build Condition - includes 1995 Interim-Build conditions plus the following: Buildings A and B, Nashua Street - Final Design, Portland Place (proposed), reconstructed Central Artery and off-ramps to Leverett Circle, and Massachusetts General Hospital (proposed development).

The 1:400 scale model of the four test conditions and surroundings within a 1,600-foot radius of the project site, was tested in a boundary layer wind tunnel. Buildings greater than twenty-five stories in height and within a 2,400-foot radius of the site, were also added upwind of the model in the tunnel. The wind tunnel simulated the natural wind conditions in the area. A detailed description of the wind tunnel and the simulation of the natural wind is given in the Technical Data appendix.

The model was fitted with eighty-two omnidirectional wind speed sensors that were connected to the wind tunnel's data acquisition system to record the mean and fluctuating components of wind speed at a full-scale height of 5 feet above grade. The photographs in Figure IV-G-1 show the model in the 1990 Existing condition, while the photographs in Figures IV-G-2 and IV-G-3 depict the model in test conditions 1993, 1995, and 2000, respectively. A comparison of pedestrian-level winds at each sensor location for each test condition (for conditions 1990, 1993, 1995, and 2000) suggests the effect of each stage of the development at each location. Where the development may cause a change in existing winds resulting in unacceptable levels of pedestrian comfort, remedial devices will be designed to eliminate the problem.

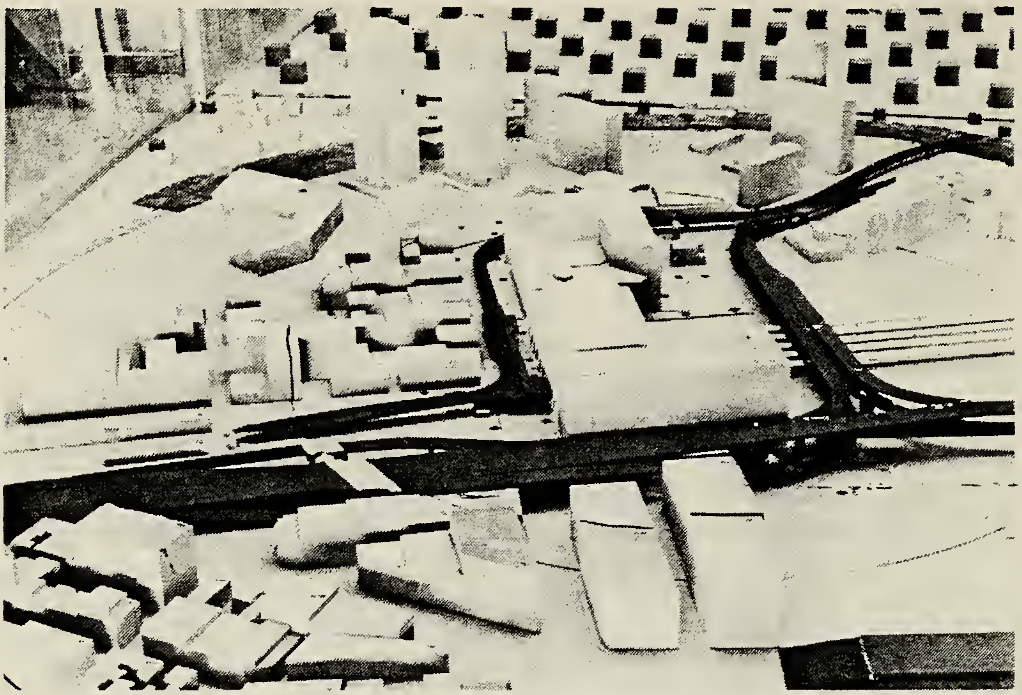
Wind speeds were recorded and analyzed for sixteen wind directions, in 22.5 degree increments, starting from true north. The test data were then combined with long-term meteorological data, recorded during the years 1945 to 1988 at Boston's Logan International Airport, in order to predict actual wind speeds. For this study, hourly wind records for each of the four seasons and over the entire year were analyzed. These wind statistics, graphically presented in Figures IV-G-4 through IV-G-6 as "wind roses", summarize the annual and seasonal conditions for wind speed, strength, and direction in the Boston area.

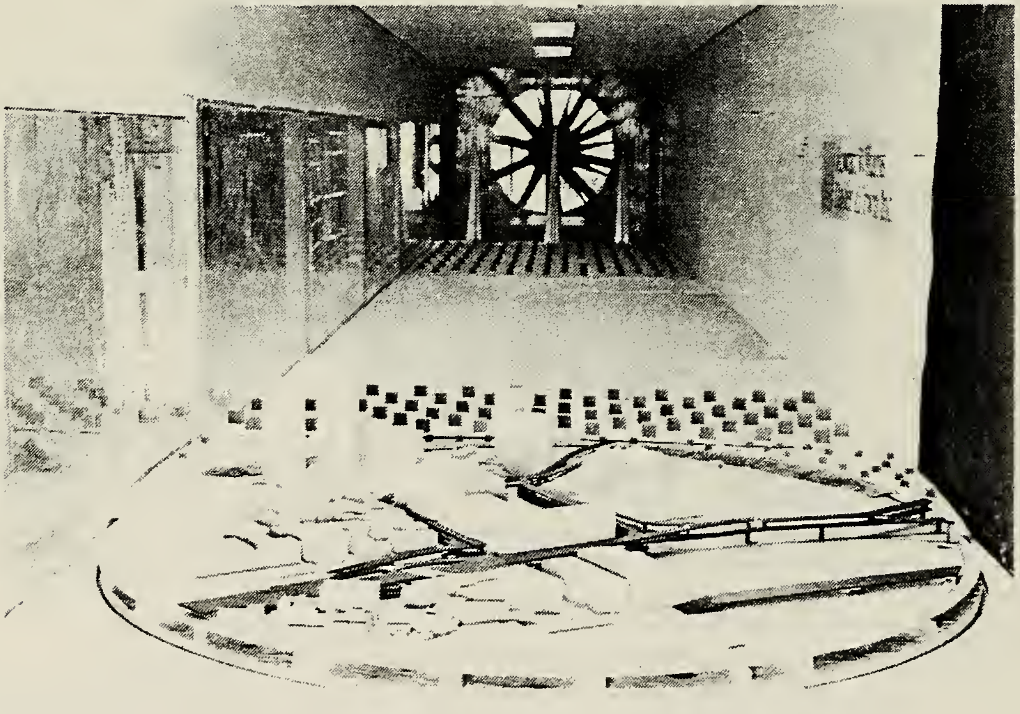
The first two wind roses in Figure IV-G-4 provide a summary of the spring (March, April, and May) wind data for Logan International Airport. When considering all spring winds, the prevalent wind directions are from the north-northwest (12 percent), northwest (11 percent) and east-southeast (11 percent). However, when only the pedestrian-level winds (i.e., 5 feet above ground level) that exceed 16 miles per hour (mph) (Strong Spring Winds) are included in the analysis, the most prominent directions are from the west through northwest (53 percent) and southwest (14 percent). It should be noted that the 16 mph threshold speed will occur, on average, 1 percent of the time during the spring season in the Boston area.

The second two wind roses in Figure IV-G-4 illustrate the prevailing summer (June, July, and August) winds blowing from the north-northwest (11 percent) and southwest (10 percent), when considering all winds. When only the winds above the 1 percent probability wind speed of 12 mph (note: this wind speed changes slightly with the season) are considered, winds from the southwest (26 percent), west-northwest (18 percent), west-southwest (18 percent) and north-northwest (14 percent) are predominant.

During the fall months (September, October, and November), winds favor the northwest (10 percent), and south (10 percent), when considering all winds (see top left wind rose in Figure IV-G-5). However, when considering winds above the one percent probability threshold of 15 mph (Strong Fall Winds), the southwest (21 percent), northwest (19 percent), west-northwest (18 percent), and north-northwest (13 percent) winds prevail (see top right wind rose in Figure IV-G-5).

For the winter (December, January, and February) wind conditions, the lower left wind rose in Figure IV-G-5 indicates that the prevailing directions are from the west through northwest (37 percent) and south (11 percent), when

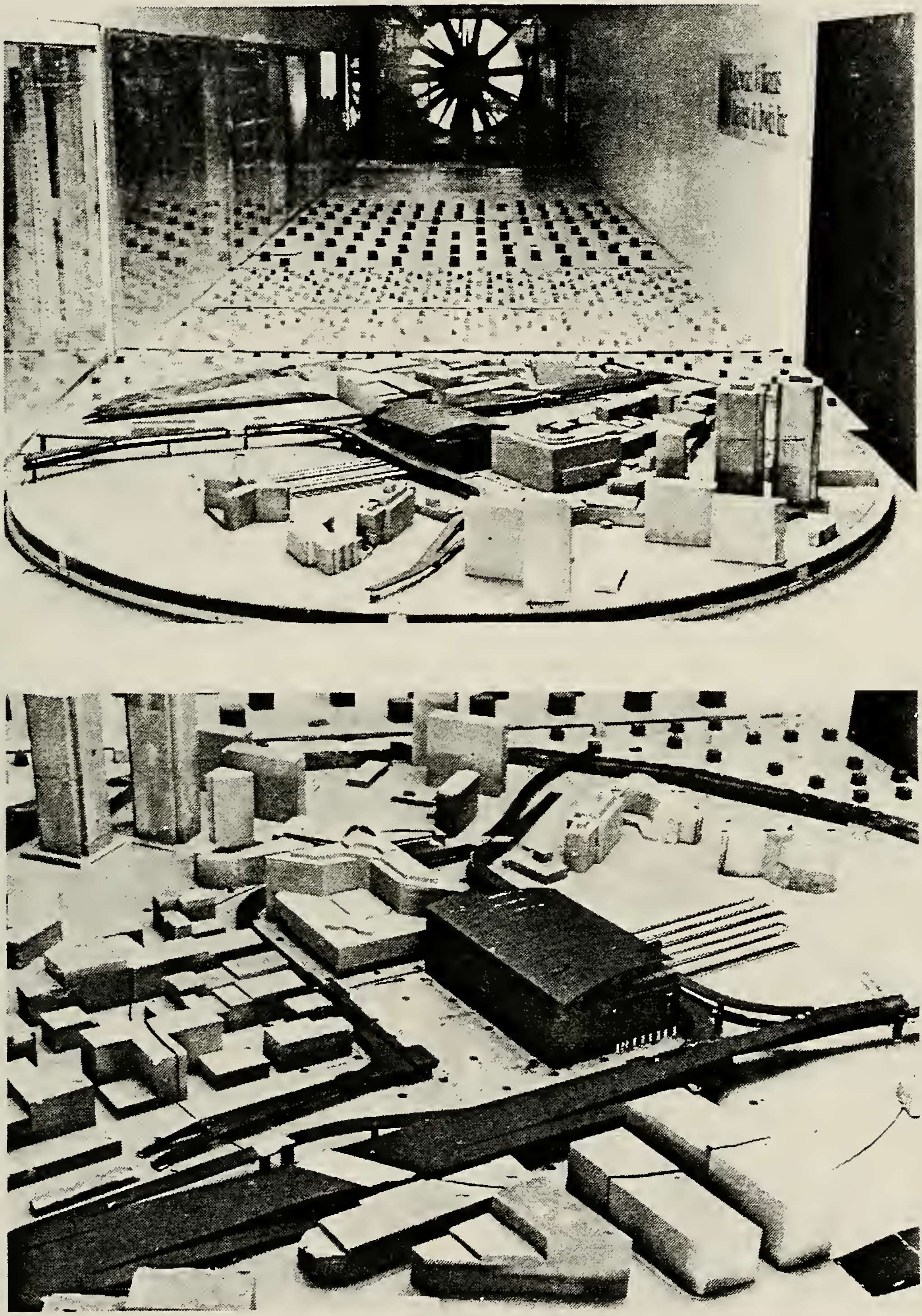




Source: Rowan Williams Davies & Irwin Inc.

Microclimate Study Model
1990 Existing Conditions

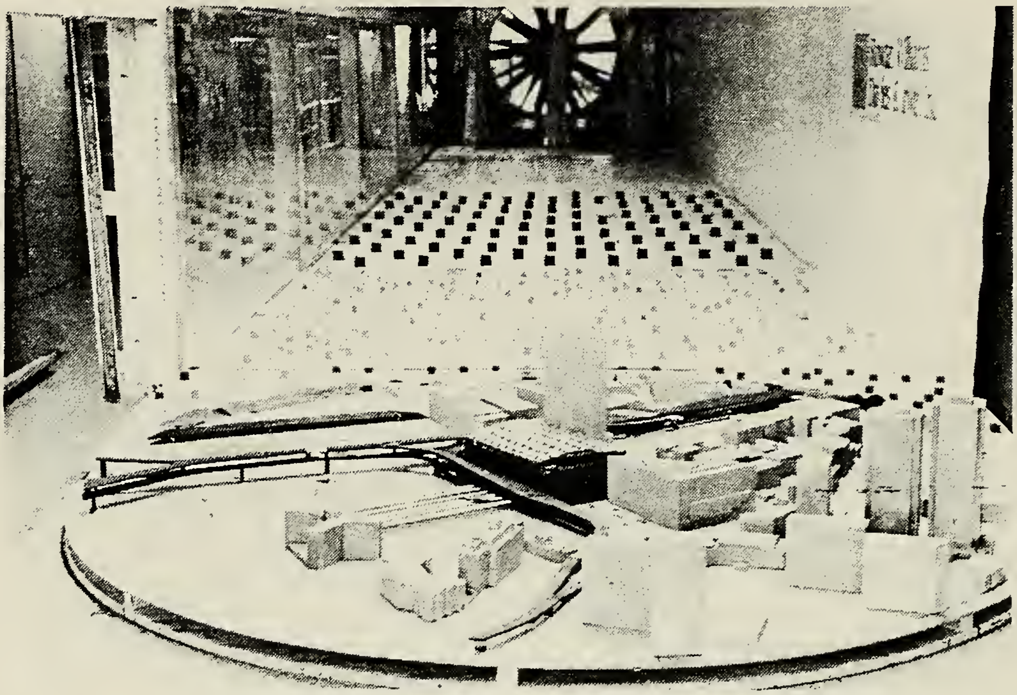
Figure IV-G-1



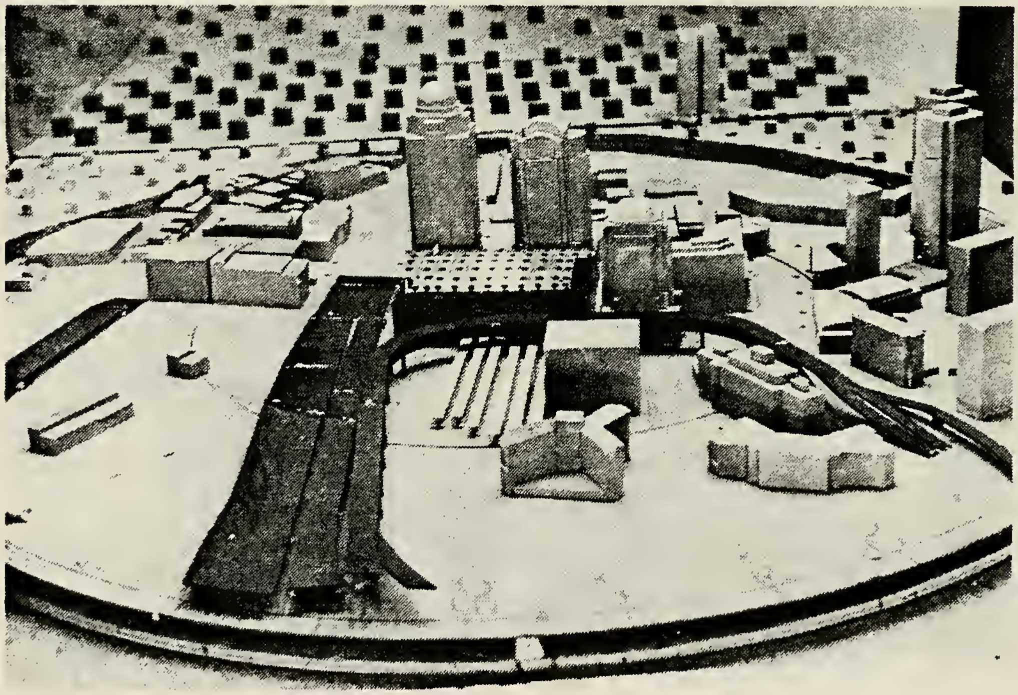
Source: Rowan Williams Davies & Irwin Inc.

Microclimate Study Model
1993 New Boston Garden

Figure IV-G-2



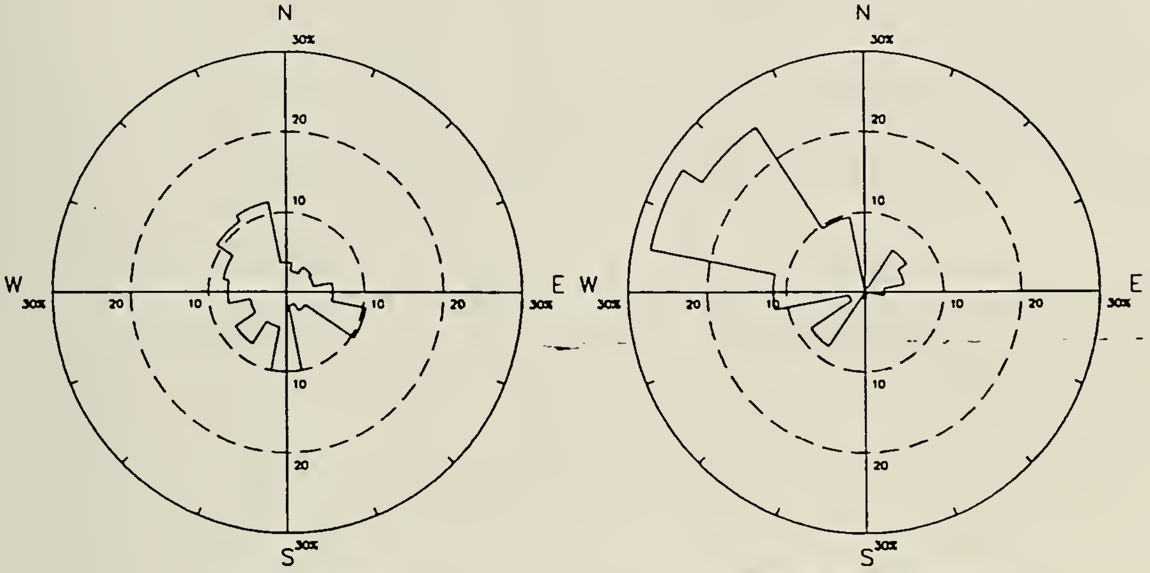
1995 Interim-Build



Source: Rowan Williams Davies & Irwin Inc.

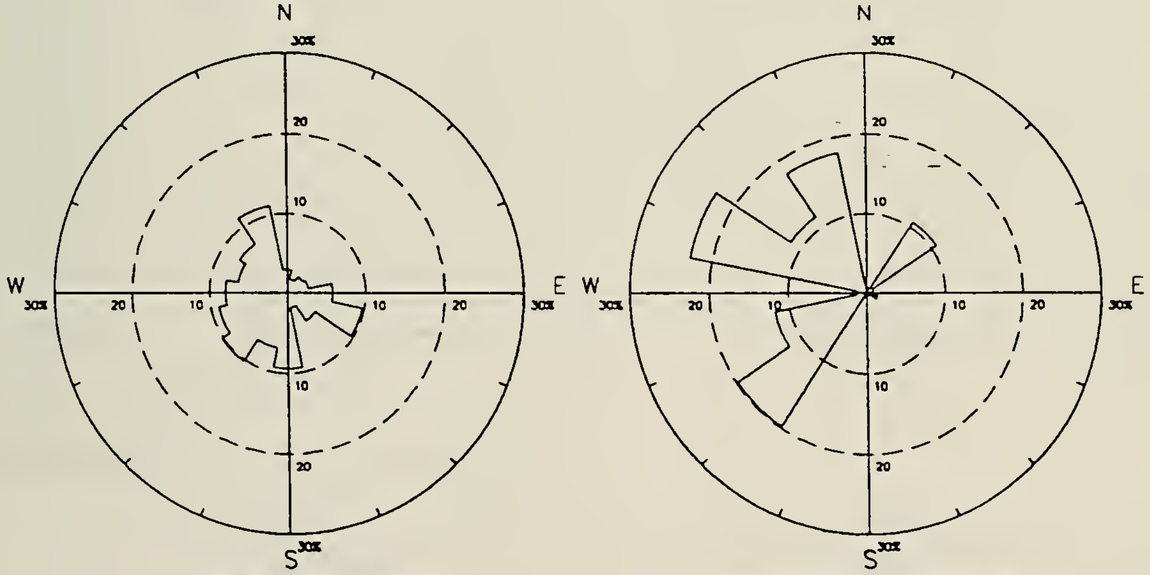
Microclimate Study Model
2000 Full-Build

Figure IV-G-3



ALL SPRING WINDS

STRONG SPRING WINDS



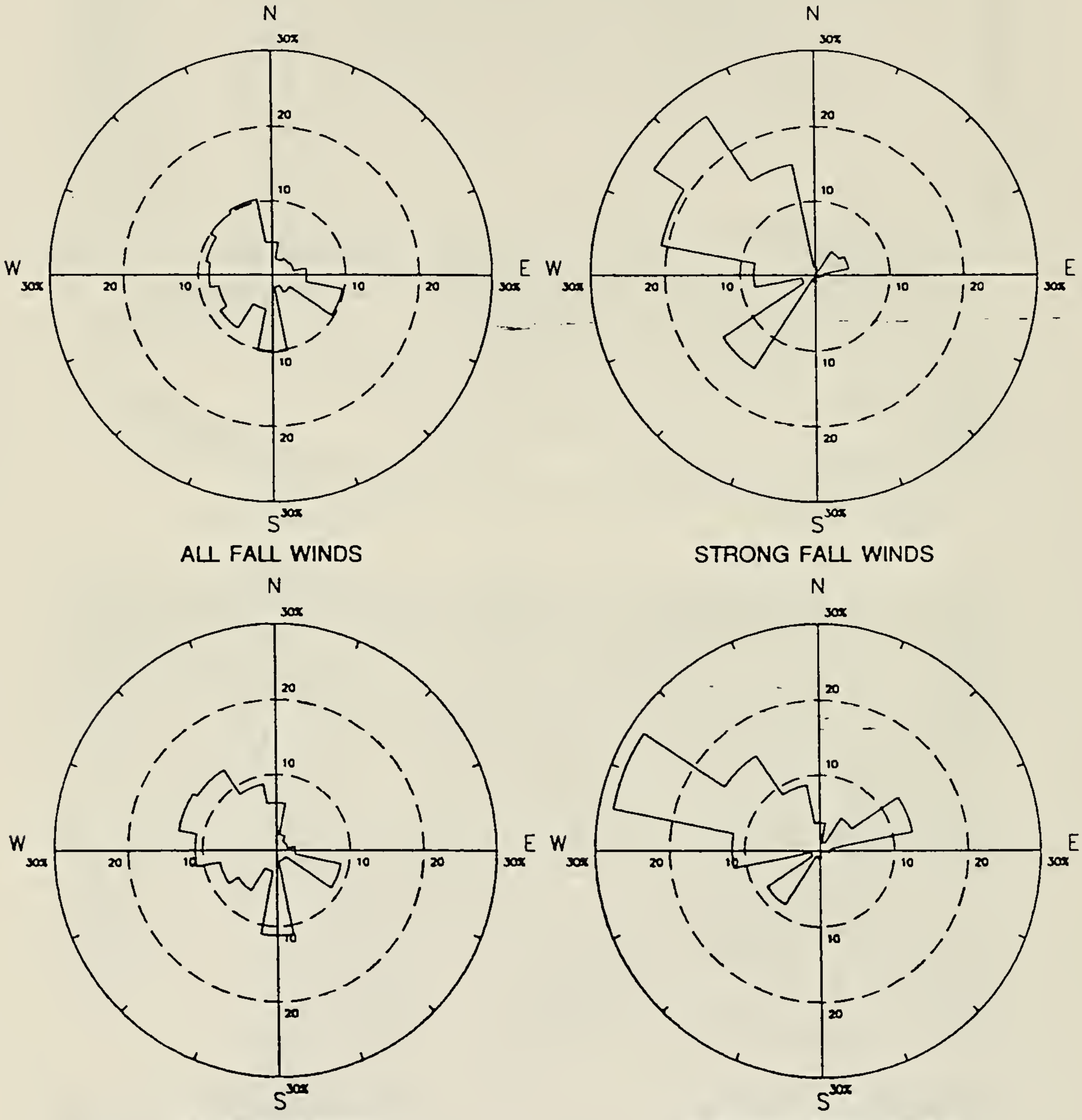
ALL SUMMER WINDS

STRONG SUMMER WINDS

Source: Rowan Williams Davies & Irwin Inc.

Directional Distribution of Spring and Summer Winds Logan International Airport (1945-1988)

Figure IV-G-4



ALL FALL WINDS

STRONG FALL WINDS

ALL WINTER WINDS

STRONG WINTER WINDS

Source: Rowan Williams Davies & Irwin Inc.

Directional Distribution of Fall and Winter Winds Logan International Airport (1945–1988)

Figure IV–G–5

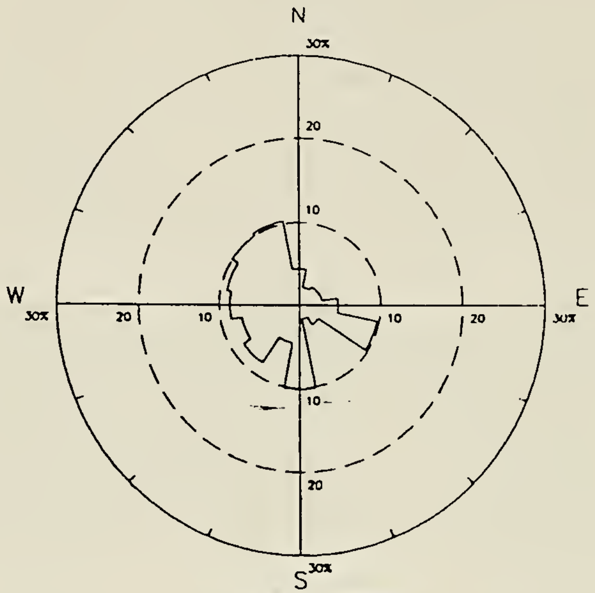
considering all winds. However, for winds above the 1 percent probability wind speed of 19 mph (Strong Winter Winds), the predominant winds are from the west-northwest (23 percent), east-northeast (15 percent), southwest (14 percent), and west (12 percent) (see lower right wind rose in Figure IV-G-5). Figure IV-G-6 summarizes the annual wind data. The top wind rose illustrates that the south (10 percent), northwest (10 percent), and north-northwest (10 percent) winds prevail when considering all winds. For winds above the 15 mph threshold wind speed (Strong Annual Winds), the prevailing wind directions are from the southwest (19 percent) and west through north-northwest (49 percent), as shown in the bottom wind rose in Figure IV-G-6.

To aid in the interpretation of the wind tunnel data and to qualitatively investigate mitigative measures, the flow visualization capabilities of an open channel water flume were used. Water flowing over the model represents wind blowing over and around the actual site. In areas where the wind conditions were of interest, dye was introduced into the water flow in order to determine the nature of the wind flow. Once the direction and magnitude of the wind were identified, the optimum placement of mitigation measures was determined. A description of the water flume and its application are described in the Technical Data appendix (Wind Section B).

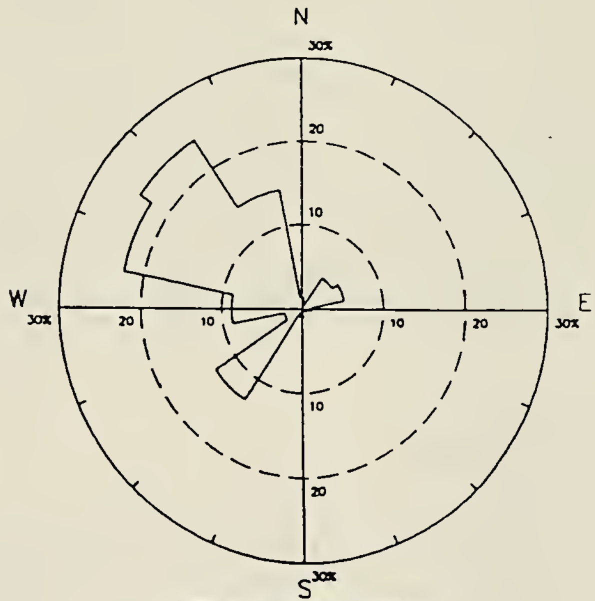
This study used state-of-the-art measurement and analysis techniques to predict the level of comfort expected at each location described. There are, however, three sources of variability that should be considered. First, although the methods of measurement and analysis are performed with precision, the sensation of comfort among individuals can be quite variable. Variations in age, individual health, clothing, and other human factors can change a particular response of an individual. The comfort limits used in this report represent an average for the total population. Second, unforeseen changes in the project area, such as the construction or removal of buildings, could affect the conditions experienced at the site. Third, the prediction of wind speeds is necessarily a statistical procedure. The wind speeds reported are for the frequency of occurrence stated (1 percent). Higher wind speeds will occur but on a less frequent basis.

PEDESTRIAN WIND COMFORT CRITERIA

The BRA has adapted two standards for assessing the relative wind comfort of pedestrians. First, the BRA wind design guidance criterion states that an effective gust velocity (mean hourly wind speed +1.5 times the root-mean-square wind speed) exceeded 1 percent of the time should be less than or equal to 31 mph. The second set of criteria used by the BRA to determine the acceptability of specific locations is derived from the Melbourne criteria. These criteria are used to determine the relative level of pedestrian wind comfort for activities such as sitting, standing, or walking. The criteria measured according to mean wind speeds are essentially as follows:



ALL ANNUAL WINDS



STRONG ANNUAL WINDS

Source: Rowan Williams Davies & Irwin Inc.

Directional Distribution
of Winds
Logan International Airport
(1945-1988)

Figure IV-G-6

Table IV-G-1 **BRA WIND CRITERIA***

Dangerous Conditions	>27
Uncomfortable for Walking	>19 and <27
Comfortable for Walking	>15 and <19
Comfortable for Standing	>12 and <15
Comfortable for Sitting	<12

* Mean wind speed (mph) exceeded 1 percent of the time. Based on Melbourne wind criteria.

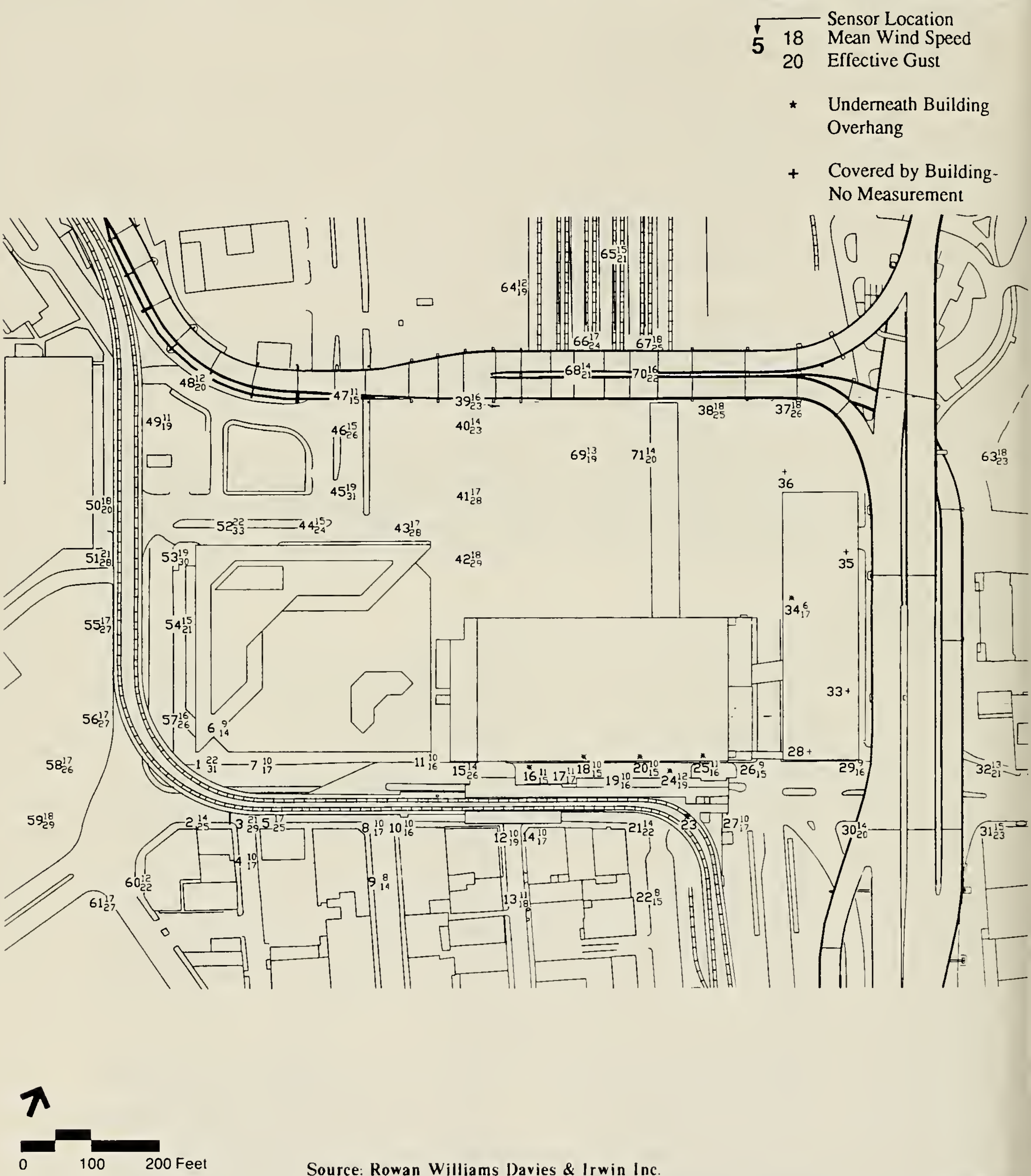
The wind climate found in a typical urban setting in Boston is generally comfortable for sidewalks and pedestrian thoroughfares. However, without any mitigation measures, this wind climate is likely to be uncomfortable for more passive activities such as sitting. The wind climate in Boston will generally satisfy the BRA effective gust velocity criterion of 31 mph.

TEST RESULTS

The pedestrian-level wind data supporting the following discussion of the test results is located in the Technical Data appendix (Wind Sections C, D, and E). It includes the predicted mean wind speeds, the level of pedestrian wind comfort, and the effective gust speeds for the eighty-two test locations.

The annual mean and effective gust wind speeds are identified on plans of the study area (Figures IV-G-7 through IV-G-10). Figure IV-G-7 identifies the annual mean and effective gust wind velocities at each sensor location for the 1990 Existing conditions. Figures IV-G-8, IV-G-9, and IV-G-10 identify the annual mean and effective gust wind velocity at each sensor location for the 1993 New Boston Garden, 1995 Interim-Build, and 2000 Full-Build conditions, respectively. Figures IV-G-11 through IV-G-13 identify the annual mean and annual effective gust speeds with mitigation in place for the 1993, 1995, and 2000 scenarios. Figures IV-G-14 through IV-G-16 identify the proposed mitigation for the 1993, 1995, and 2000 conditions, respectively.

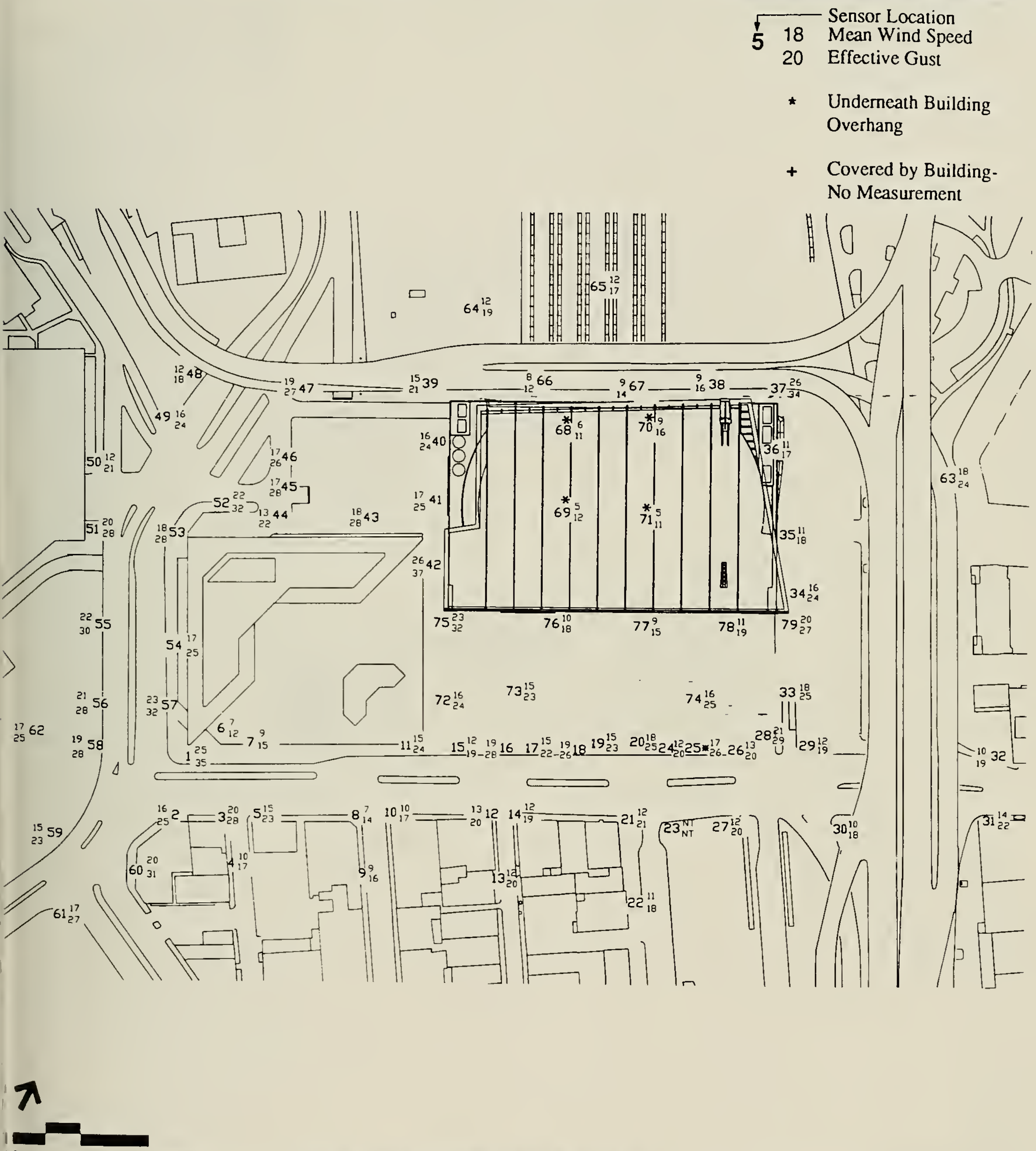
For additional information concerning the effects of each wind direction at any test location, refer to the Technical Data appendix (Wind Section E). It reports the wind tunnel test data and indicates the ratio of the ambient mean wind speed at each location to the mean wind speeds for each location and all four test conditions. Using these data, wind speeds for each test condition can be compared and problem wind directions readily determined. The use and interpretation of these test data are described in the Technical Data appendix (Wind Section E).



Source: Rowan Williams Davies & Irwin Inc.

Pedestrian-Level Wind Analysis
1990 Existing Conditions

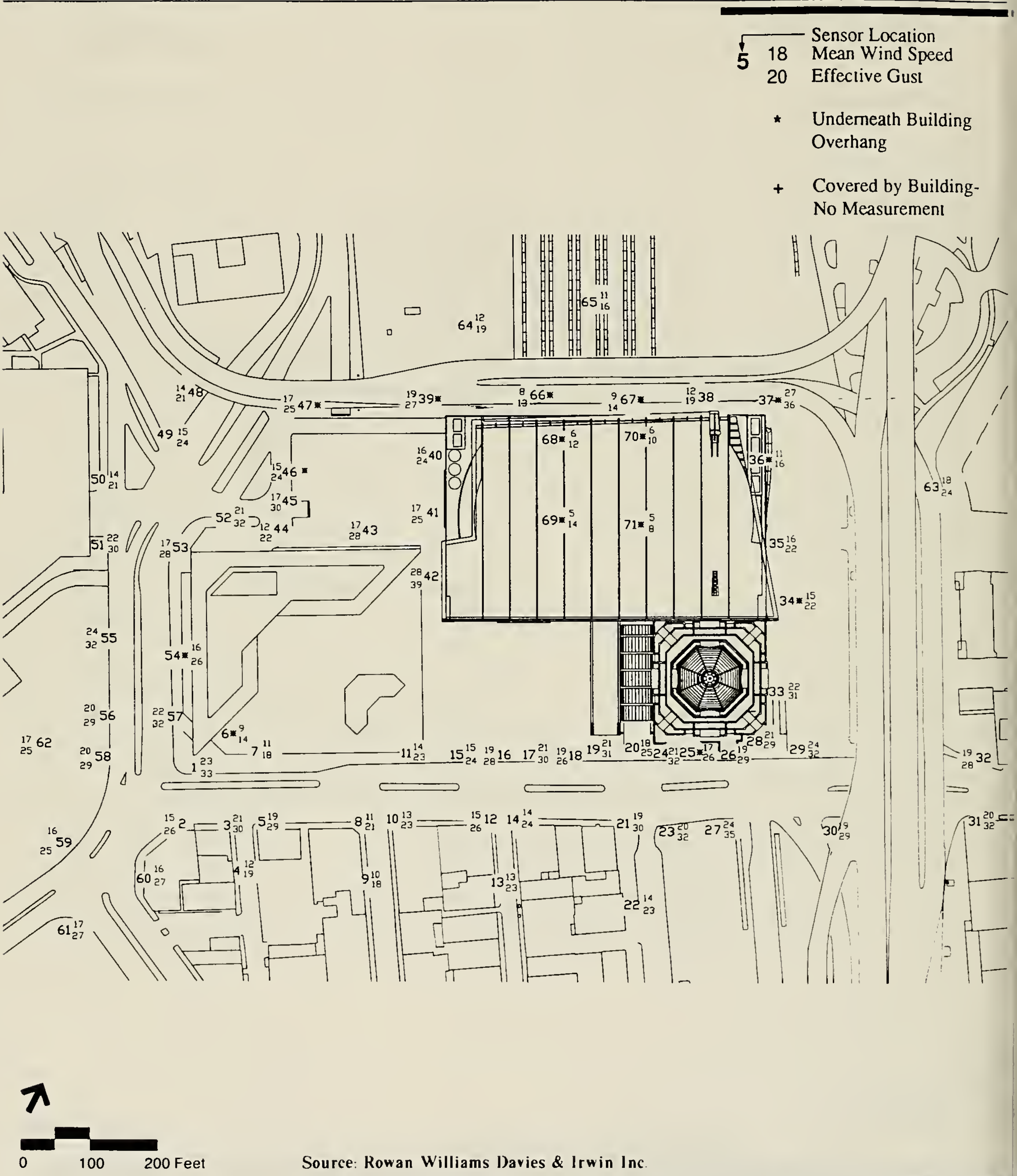
Figure IV-G-7



Source: Rowan Williams Davies & Irwin Inc.

Pedestrian-Level Wind Analysis
1993 New Boston Garden Arena
Pre-Mitigation Results

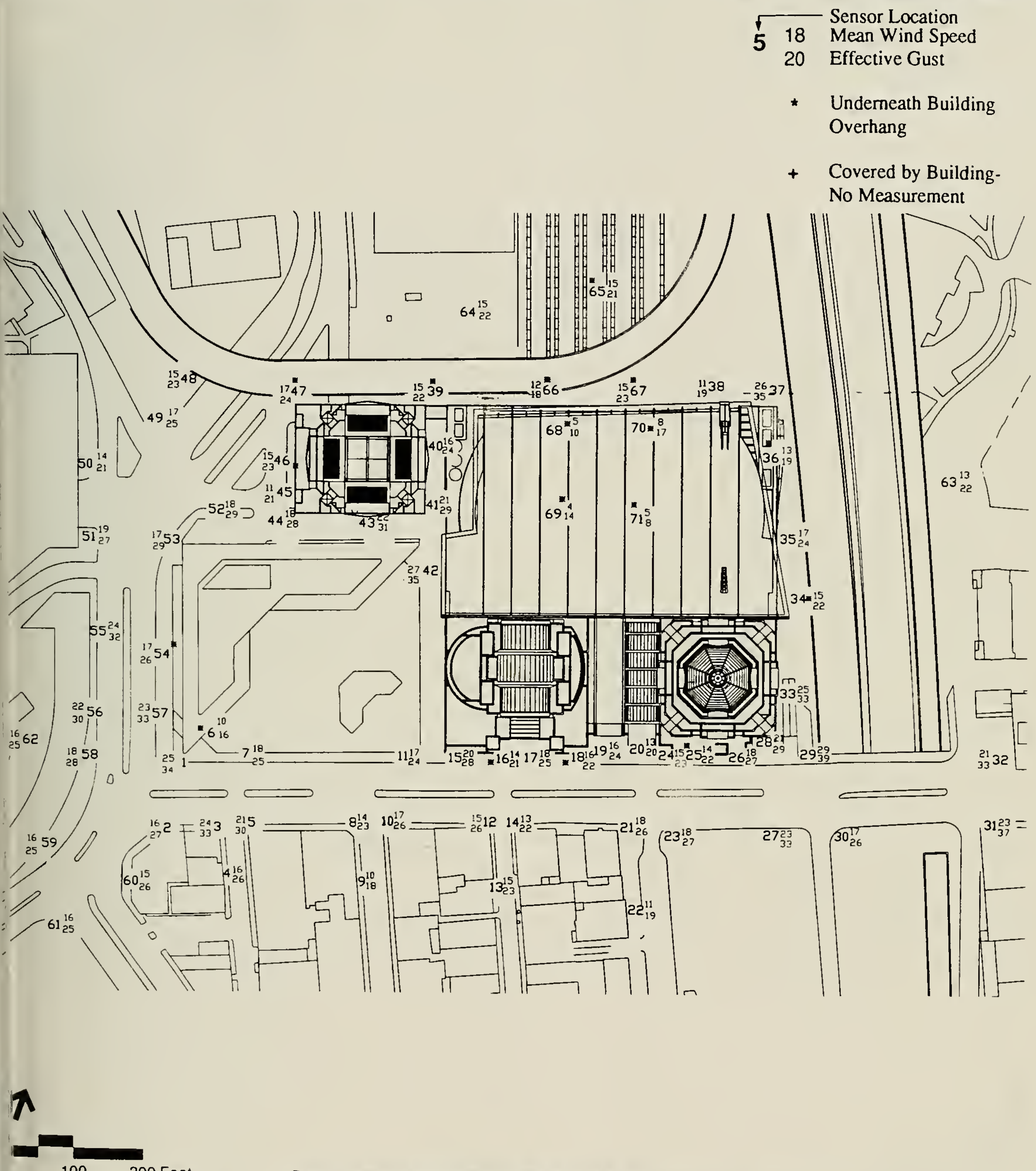
Figure IV-G-8



Source: Rowan Williams Davies & Irwin Inc.

Pedestrian-Level Wind Analysis
1995 Interim-Build Conditions
Pre-Mitigation Results

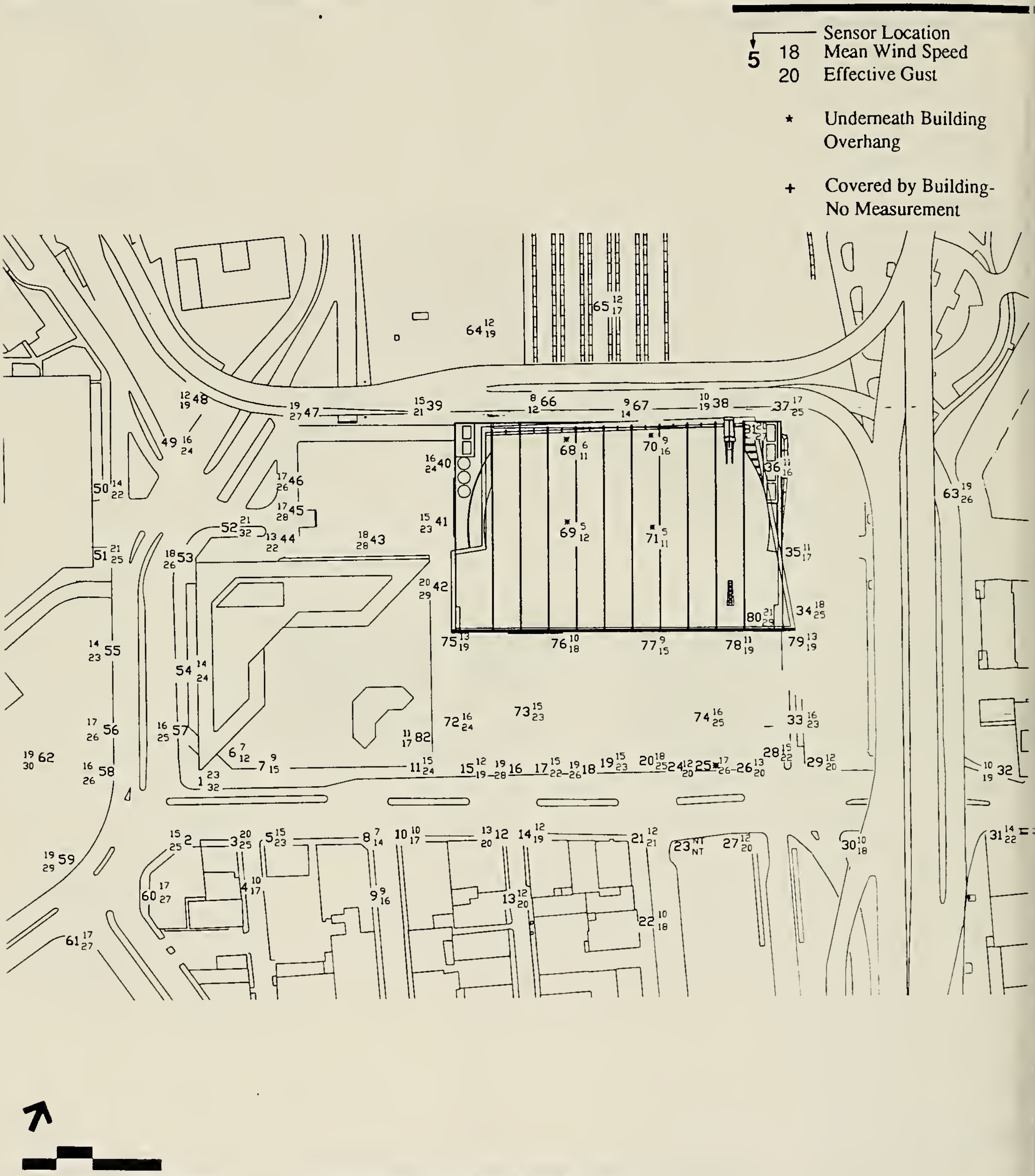
Figure IV-G-9


Sensor Location
5 18 Mean Wind Speed
20 Effective Gust
* Underneath Building Overhang
+ Covered by Building- No Measurement
100
200 Feet

Source: Rowan Williams Davies & Irwin Inc.

Pedestrian-Level Wind Analysis
2000 Full-Build Conditions
Pre-Mitigation Results

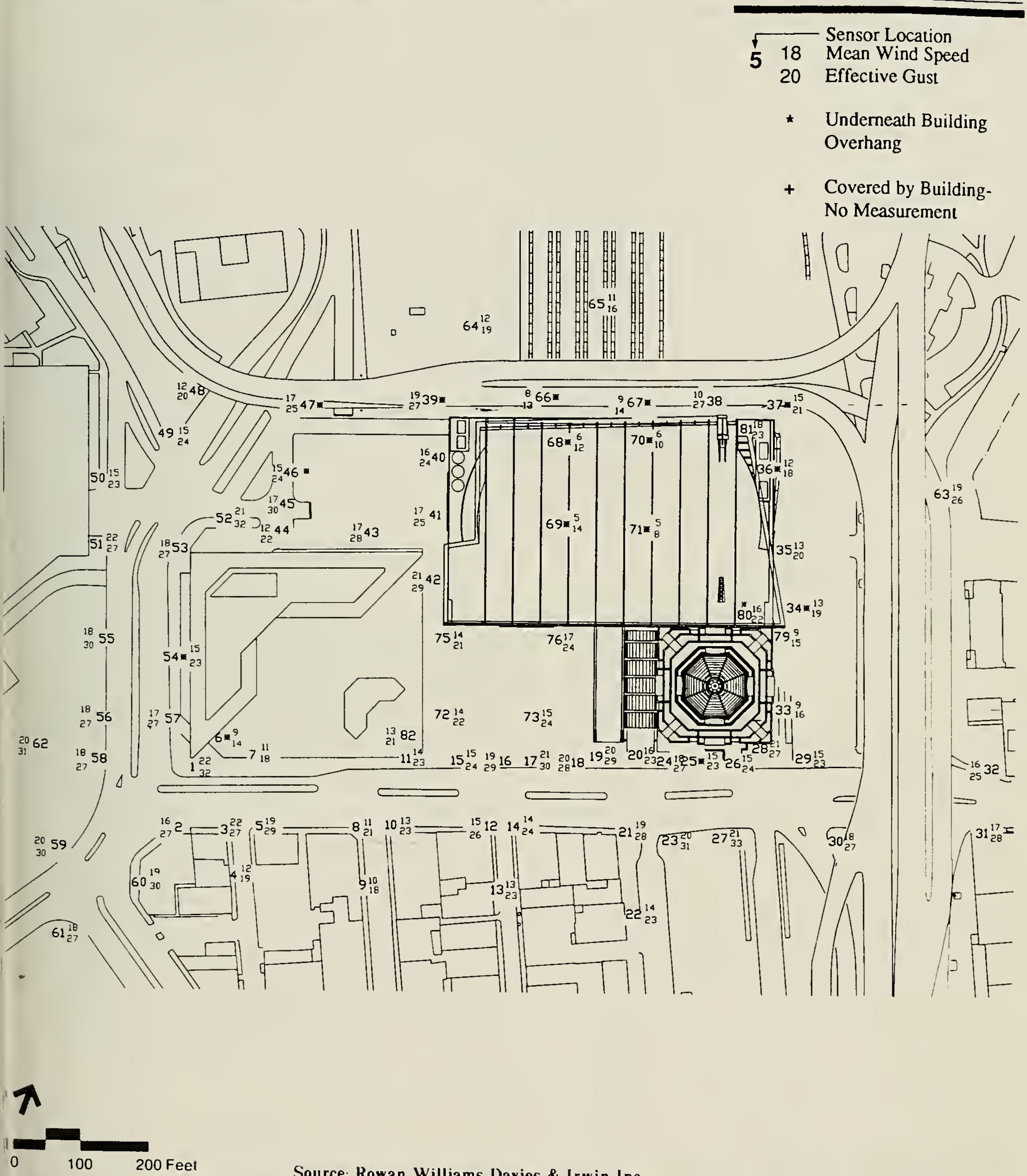
Figure IV-G-10


Sensor Location
5 18 Mean Wind Speed
20 Effective Gust
* Underneath Building Overhang
+ Covered by Building- No Measurement
0 100 200 Feet

Source: Rowan Williams Davies & Irwin Inc.

Pedestrian-Level Wind Analysis
1993 New Boston Garden
Post-Mitigation Results

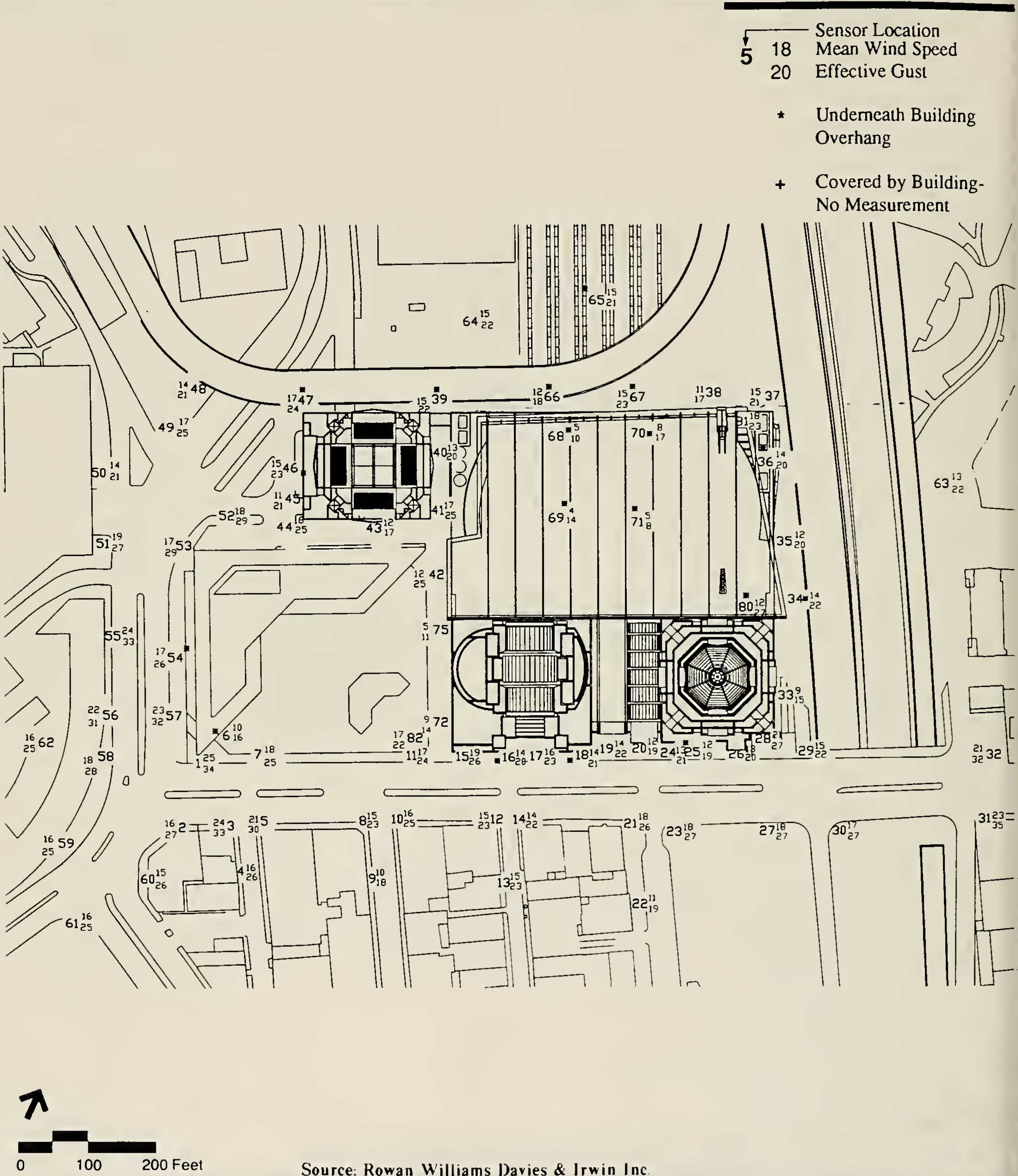
Figure IV-G-11



Source: Rowan Williams Davies & Irwin Inc.

Pedestrian-Level Wind Analysis
1995 Interim-Build Conditions
Post-Mitigation Results

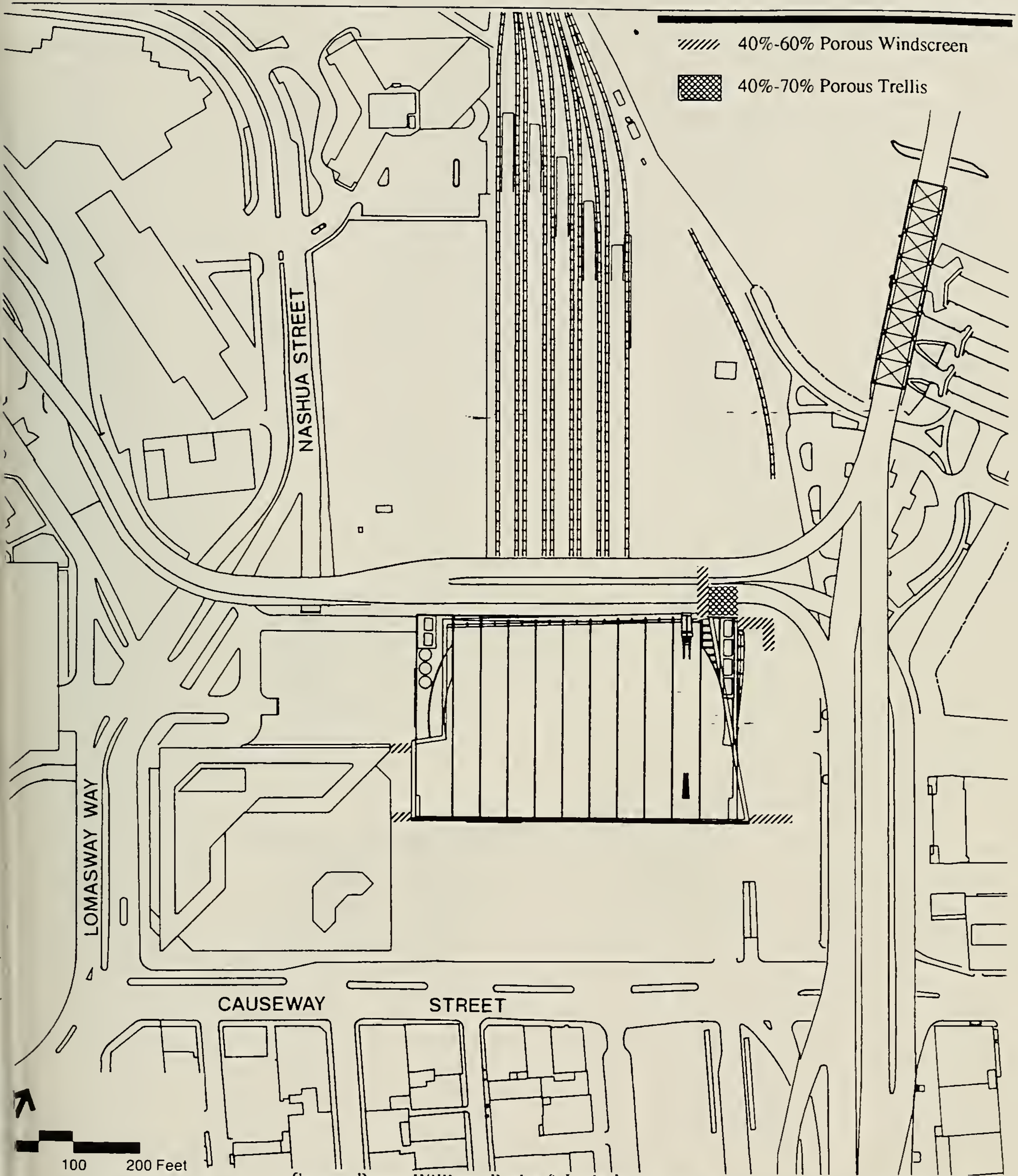
Figure IV-G-12


5
18
20
Sensor Location
Mean Wind Speed
Effective Gust
* Underneath Building Overhang
+ Covered by Building-No Measurement
0
100
200 Feet

Source: Rowan Williams Davies & Irwin Inc.

Pedestrian-Level Wind Analysis
2000 Full-Build Conditions
Post-Mitigation Results

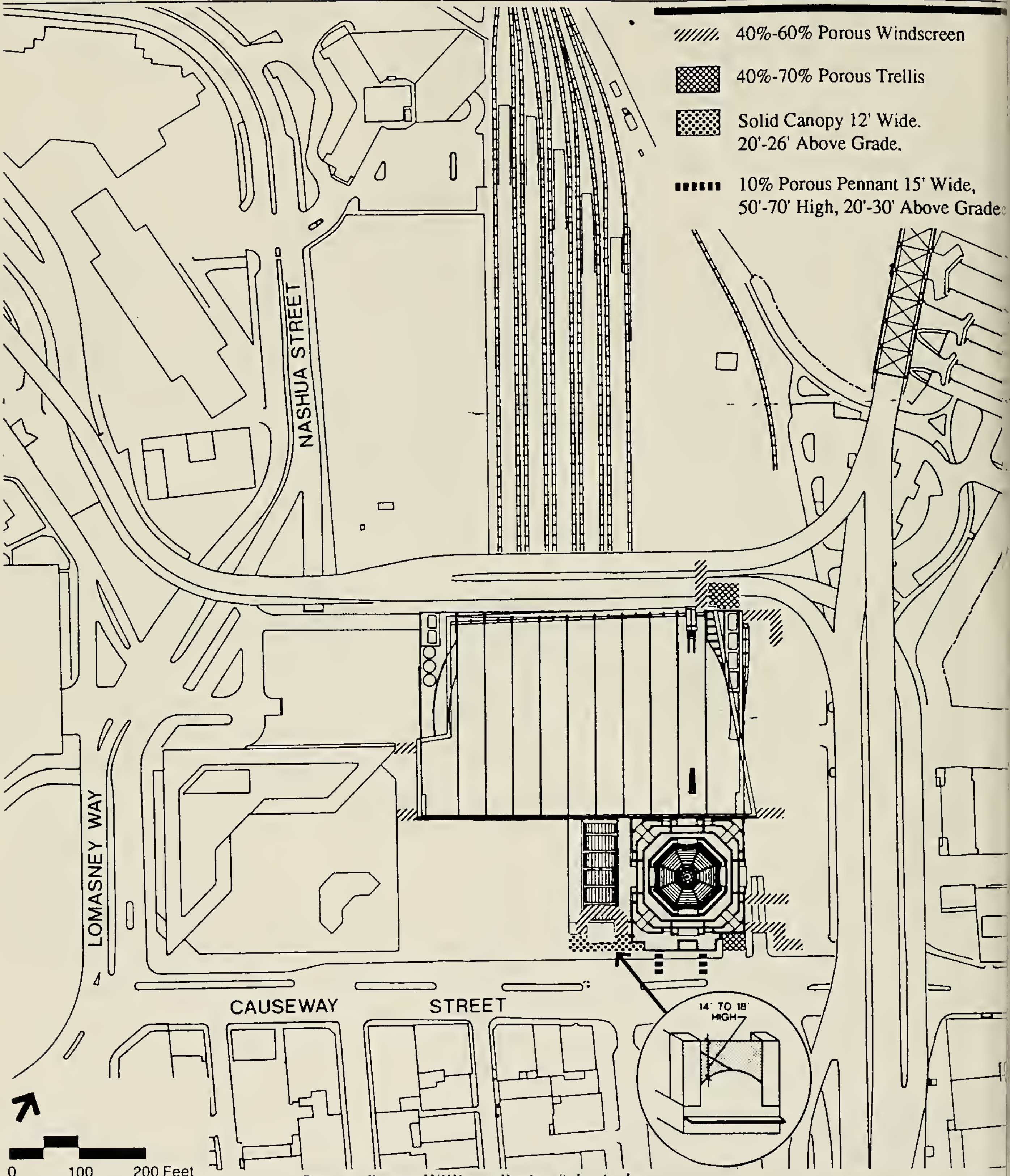
Figure IV-G-13



Source: Rowan Williams Davies & Irwin Inc.

Proposed Wind Mitigation Measures
1993 New Boston Garden

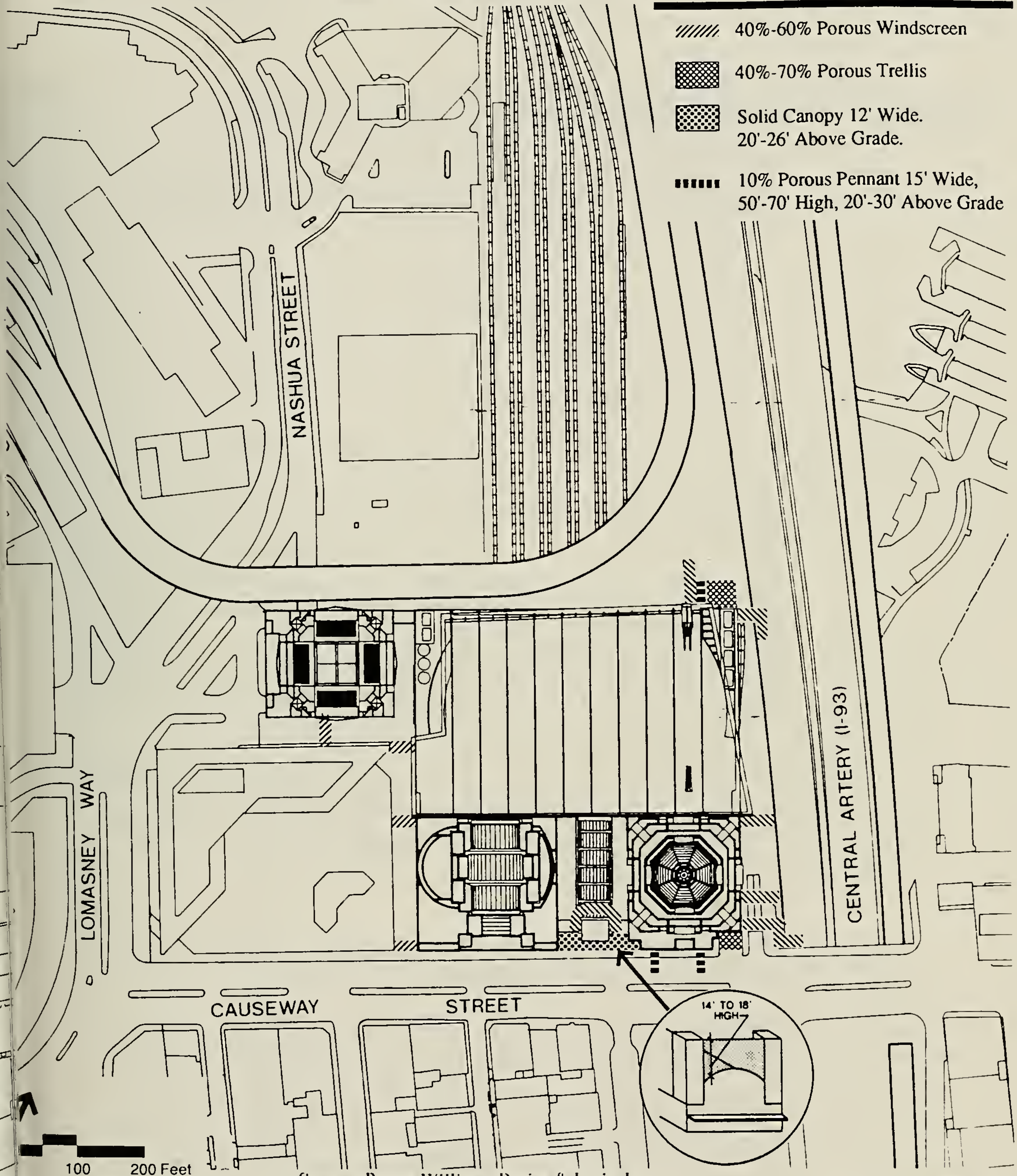
Figure IV-G-14


40%-60% Porous Windscreen
40%-70% Porous Trellis
Solid Canopy 12' Wide. 20'-26' Above Grade.
10% Porous Pennant 15' Wide, 50'-70' High, 20'-30' Above Grade
NASHUA STREET
LOMASNEY WAY
CAUSEWAY STREET
14' TO 18' HIGH
0
100
200 Feet

Source: Rowan Williams Davies & Irwin Inc

Proposed Wind Mitigation Measures
1995 Interim-Build

Figure IV-G-15


40%-60% Porous Windscreen
40%-70% Porous Trellis
Solid Canopy 12' Wide. 20'-26' Above Grade.
10% Porous Pennant 15' Wide, 50'-70' High, 20'-30' Above Grade
NASHUA STREET
LOMASNEY WAY
CAUSEWAY STREET
CENTRAL ARTERY (I-93)
14' TO 18' HIGH
100
200 Feet

Source: Rowan Williams Davies & Irwin Inc.

Proposed Wind Mitigation Measures 2000 Full-Build Figure IV-G-16

The following is a summary of the predicted pre-mitigation pedestrian-level wind conditions in and around the development site for the four conditions studied:

- 1990 Existing site conditions
- 1993 New Boston Garden conditions
- 1995 Interim-Build conditions
- 2000 Full-Build conditions

The results of the wind analysis have been compared to the BRA wind criteria.

Assessment of Mean Wind Speeds

The test results for each of the eighty-two wind sensor locations are discussed in groupings according to the specific locations representing the following areas: Causeway Street; Merrimac Street, Lowell Square, and Lomasney Way; Nashua Street; Lancaster Street, Portland Street, Friend Street, and Canal Street; the Boat Landing; North Station; and the periphery of the project site. For example, Causeway Street is comprised of twenty-eight test locations, namely, 1-3, 5-8, 10-12, 14-21, and 23-32. These test locations are discussed under the Causeway Street grouping for all four test configurations studied.

The pedestrian-level wind effect in each study area is described in the following text. A table which summarizes the number of locations suitable for either sitting, standing, and walking, for all seasons and all test configurations, has been included at the beginning of each area analysis.

Causeway Street

Table IV-G-2 presents the results of the pre-mitigation wind analysis for the twenty-eight locations studied along Causeway Street.

Existing Conditions. Under 1990 Existing conditions, the wind climate along Causeway Street was generally suitable for sitting, standing, or walking at twenty-five out of twenty-seven locations on an annual basis and during the spring, fall, and winter. Twenty-six of the locations recorded acceptable summer wind conditions. Locations 1 and 3 were exceptions. Location 1 was uncomfortable for walking annually and for all seasons. Location 3 was suitable for walking in the summer but was considered uncomfortable for walking during the spring, fall, winter, and annually. These uncomfortable wind conditions were due to strong upper-level winds striking the GSA Building and deflecting down to sidewalk level.

Table IV-G-2 CAUSEWAY STREET WIND CONDITIONS: NUMBER OF LOCATIONS SUITABLE FOR SITTING, STANDING, OR WALKING*

Season	1990 Existing Conditions	1993** New Boston Garden	1995** Interim-Build	2000** Full-Build
Annual	25	24	18	19
Spring	25	22	13	19
Summer	26	26	27	25
Fall	25	24	18	19
Winter	25	23	13	19

* Twenty-seven locations tested on Causeway Street for 1990 and 1993 test configurations: Locations 1-3, 5-8, 10-12, 14-21, 23-27, and 29-32.
Twenty-eight locations tested on Causeway Street for 1995 and 2000 test configurations: Locations 1-3, 5-8, 10-12, 14-21, 23-32.

** Pre-mitigation results.

1993 New Boston Garden. The 1993 New Boston Garden (with the elevated Green Line in place) produced summer wind speeds comparable to Existing conditions. Suitable fall and annual wind conditions occurred at twenty-four out of twenty-seven locations. Acceptable spring wind conditions were recorded at twenty-two of the locations, and twenty-three of the locations were acceptable during the winter. Locations 1 and 3 were predicted to remain uncomfortable for walking during the spring, fall, winter, and annually, while Location 1 remained uncomfortable for walking during the summer months. Furthermore, Location 28 was predicted to be uncomfortable for walking in the spring, fall, winter, and annually. Locations 16 and 18 were predicted to be uncomfortable in the spring, and Location 16 was also predicted to be uncomfortable in the winter.

1995 Interim-Build. The 1995 Interim-Build condition showed increased wind speeds along Causeway Street during the spring, fall, winter, and annually. During the summer months, wind speeds were predicted to be comparable to Existing conditions. Uncomfortable wind conditions were recorded at Locations 1, 3, 17, 19, 23, 24, 27, 28, 29, 30, and 31 during the spring, fall (excluding 30), and winter. In addition, uncomfortable spring winds were recorded at Locations 16, 18, 21, and 26, and uncomfortable winter winds were predicted at Locations 5, 16, 21, and 32. Location 1 was predicted to be uncomfortable for walking in the summer, and the wind conditions at Locations 1, 15, 17, 19, 23, 24, 27, 28, 29, and 31 were predicted to be uncomfortable for walking annually.

2000 Full-Build. The 2000 Full-Build condition did not create spring, fall, winter, and annual wind comfort levels equal to Existing conditions; however, it was predicted to improve over the 1995 Interim-Build wind conditions. Annually, wind speeds were predicted to be comfortable for walking or better at nineteen out of twenty-eight locations. In the summer, twenty-five of the locations had acceptable wind conditions. During the spring, fall, winter, and annually, Locations 1, 3, 5, 15, 27, 28, 31, and 32 were uncomfortable for walking. Locations 1, 3, and 29 were uncomfortable during the summer months. Dangerous wind conditions were noted at Location 29 during the spring, fall, winter, and annually.

Locations 1 and 3 were consistently predicted to be uncomfortable for walking in all test configurations, which indicates that these wind speeds are an existing problem.

Merrimac Street, Lowell Square, and Lomasney Way

Table IV-G-3 presents the results of the pre-mitigation wind analysis for the fourteen locations studied along Merrimac Street, Lowell Square, and Lomasney Way.

Table IV-G-3 **MERRIMAC STREET, LOWELL SQUARE, AND LOMASNEY WAY WIND CONDITIONS: NUMBER OF LOCATIONS SUITABLE FOR SITTING, STANDING, OR WALKING***

Season	1990 Existing Conditions	1993** New Boston Garden	1995** Interim-Build	2000** Full-Build
Annual	12	8	8	11
Spring	11	7	8	11
Summer	14	12	11	12
Fall	12	9	8	11
Winter	10	7	8	9

* Fourteen locations tested on Merrimac Street, Lowell Square, and Lomasney Way: Locations 49-62.
** Pre-mitigation results.

Existing Conditions. The annual wind climate for Existing conditions was suitable for sitting, standing, or walking at twelve of the locations. On a seasonal basis, it was predicted that the suitability for sitting, standing, or walking varied from a low of ten locations during the winter months to fourteen locations during the summer months. Uncomfortable wind conditions were noted at Locations 51 and 52 during the spring, fall, and winter seasons and annually. In addition, uncomfortable wind conditions were recorded at Location 55 during the spring and at Locations 53 and 62 during the winter. These uncomfortable wind conditions are attributed to winds interacting with the existing buildings in the area.

1993 New Boston Garden. The 1993 New Boston Garden condition with elevated Green Line produced suitable wind speeds at eight of the fourteen locations annually. The significant drop in suitability at Locations 55, 56, 57, 58, and 60 can be attributed to the presence of the proposed Lowell Square development rather than the construction of the New Boston Garden. The majority of winds deflecting off the New Boston Garden were prevented from reaching these affected locations along Lomasney Way by the General Services Administration (GSA Building), situated between these locations and the New Boston Garden. Winds uncomfortable for walking were noted at Locations 51, 52, 55, 56, and 57 during the spring, fall, and winter months and annually. Locations 55 and 57 were also uncomfortable for walking during the summer months. Locations 58 and 60 were uncomfortable during the spring and winter; and, in addition, Location 60 was uncomfortable annually. The decision to include Lowell Square in the 1993 and 1995 test configurations was based on anticipated market phasing of the development. Removal of the development for this configuration would have produced wind conditions similar to the 1990 Existing conditions.

1995 Interim-Build. The 1995 Interim-Build condition produced an annual wind climate that was suitable for sitting, standing, or walking at eight of fourteen locations annually. Seasonally, the wind conditions were appropriate for sitting, standing, or walking at eight locations during the spring, fall, and winter. In the summer, eleven of the locations tested were suitable for sitting, standing, or walking. Uncomfortable spring, fall, winter, and annual wind conditions were recorded at Locations 51, 52, 55, 56, 57, and 58. During the summer, only Locations 51, 55, and 57 had uncomfortable wind conditions. These conditions on Merrimac Street, Lowell Square, and Lomasney Way appear to be the result of existing buildings combined with the proposed Lowell Square development. The removal of the elevated Green Line also appears to reduce the suitability of 1995 wind conditions in this area.

2000 Full-Build. Wind conditions were predicted to generally improve (when compared to the other proposed conditions) along the Merrimac Street connector under the 2000 Full-Build condition. Annual wind conditions along the Merrimac Street connector were predicted to be suitable for sitting, standing, or walking at eleven of the locations. The exceptions were Locations 55 and 56, both of which were partially affected by the presence of the proposed Lowell Square development. Locations 55, 56, and 57 were uncomfortable for walking during the spring, fall, winter, and annually. In the summer, Locations 55 and 57 were uncomfortable for walking, while Location 58 was predicted to be uncomfortable during the winter. As in the 1995 analysis, these wind conditions appear to result from winds interacting with the existing buildings and the Lowell Square development.

Nashua Street

Table IV-G-4 presents the results of the pre-mitigation wind analysis for the four locations studied along Nashua Street.

Existing Conditions. Under the 1990 Existing condition, the wind environment was appropriate for sitting, standing, or walking at all locations during the spring, summer, fall, and annually. In the winter, three of the sensor locations recorded favorable wind activity. Only Location 45 registered uncomfortable winds during the winter, due to the localized impact of the existing buildings.

Table IV-G-4 NASHUA STREET WIND CONDITIONS: NUMBER OF LOCATIONS SUITABLE FOR SITTING, STANDING, OR WALKING*

Season	1990 Existing Conditions	1993** New Boston Garden	1995** Interim-Build	2000** Full-Build
Annual	4	4	4	4
Spring	4	4	4	4
Summer	4	4	4	4
Fall	4	3	4	4
Winter	3	3	4	4

* Four locations tested on Nashua Street: Locations 45-48.

** Pre-mitigation results.

1993 New Boston Garden. Construction of the proposed New Boston Garden with the elevated Green Line in place generally maintained the existing wind climate along Nashua Street for all seasons and annually, except at Location 47. Location 47 was subject to increased wind activity creating uncomfortable wind conditions during the fall and winter seasons. Location 45, however, was subject to a slight improvement as it changed from a category of uncomfortable for walking to suitable for walking during the winter season.

1995 Interim-Build. Under the 1995 Interim-Build condition, the wind conditions along Nashua Street became suitable for sitting, standing, or walking at all four locations for all seasons and annually.

2000 Full-Build. The 2000 Full-Build condition was predicted to produce wind conditions equal to or better than the 1995 Interim-Build condition for all seasons and annually, as more locations became suitable for sitting and standing.

Lancaster, Portland, Friend, and Canal Streets

Table IV-G-5 presents the results of the pre-mitigation wind analysis for the four locations studied along Lancaster, Portland, Friend, and Canal Streets.

Under Existing and proposed conditions, the wind environment at all of the various locations were suitable for sitting, standing or walking. An increase in wind conditions suitable for sitting to wind conditions suitable for walking at Location 4 on Lancaster Street for all four seasons and annually can be attributed to the addition of the Portland Place development for the year 2000.

Table IV-G-5 LANCASTER, PORTLAND, FRIEND, AND CANAL STREETS WIND CONDITIONS: NUMBER OF LOCATIONS SUITABLE FOR SITTING, STANDING, OR WALKING*

Season	1990 Existing Conditions	1993** New Boston Garden	1995** Interim-Build	2000** Full-Build
Annual	4	4	4	4
Spring	4	4	4	4
Summer	4	4	4	4
Fall	4	4	4	4
Winter	4	4	4	4

* Four locations tested on Lancaster, Portland, Friend, and Canal streets: Locations 4, 9, 13, 22.
** Pre-mitigation results.

Boat Landing

Table IV-G-6 presents the results of the pre-mitigation wind analysis for the one location studied at the proposed Boat Landing at Revere Park.

Table IV-G-6 BOAT LANDING WIND CONDITIONS: NUMBER OF LOCATIONS SUITABLE FOR SITTING, STANDING, OR WALKING*

Season	1990 Existing Conditions	1993** New Boston Garden	1995** Interim-Build	2000** Full-Build
Annual	1	1	1	1
Spring	1	1	1	1
Summer	1	1	1	1
Fall	1	1	1	1
Winter	1	0	1	1

* One location tested at the boat landing: Location 63.
** Pre-mitigation results.

The existing wind climate at this location was minimally affected by the proposed development conditions. The 1993 New Boston Garden condition increased the wind speeds 1 mph. The increase from 19 mph to 20 mph during the winter was sufficient to create a change in categories from suitable for walking to uncomfortable for walking. It is unlikely, given the Existing conditions, that this change in wind velocity would be noticed by pedestrians.

In the 2000 Full-Build condition, wind conditions generally improved. The summer wind speeds became suitable for sitting, and the spring, fall, winter, and annual wind speeds became suitable for standing.

North Station

Table IV-G-7 presents the results of the pre-mitigation wind analysis for the eight locations studied at North Station.

Table IV-G-7 **NORTH STATION WIND CONDITIONS: NUMBER OF LOCATIONS SUITABLE FOR SITTING, STANDING OR WALKING***

Season	1990 Existing Conditions	1993** New Boston Garden	1995** Interim-Build	2000** Full-Build
Annual	8	8	8	8
Spring	8	8	8	8
Summer	8	8	8	8
Fall	8	8	8	8
Winter	8	8	8	8

* Eight locations tested at the North Station: Locations 64-71.

** Pre-mitigation results.

The wind climate on the train platforms created by the various proposed conditions was equal to or better than the existing wind climate. In all cases, the four seasons and annual wind conditions were suitable for sitting, standing, or walking. There were no instances of uncomfortable wind activity.

Periphery of the Project Site

Table IV-G-8 presents the results of the pre-mitigation wind analysis for the various locations studied at the periphery of the project site.

Existing Conditions. Existing wind comfort levels were suitable for sitting, standing or walking at all locations annually and for all four seasons.

1993 New Boston Garden. Wind conditions for the 1993 New Boston Garden condition with elevated Green Line indicate that sixteen out of the twenty locations were acceptable for sitting, standing or walking for the spring, fall, winter, and annually. Summer wind conditions were predicted to be acceptable at eighteen of the locations. The exceptions were: Locations 37 and 42, which were uncomfortable for walking during the spring, summer, fall, and annually and Locations 75 and 79, which were predicted to be uncomfortable during the spring, fall, winter, and annually. Dangerous wind conditions were predicted to occur at Locations 37 and 42 during the winter.

Table IV-G-8 PERIPHERY OF THE PROJECT SITE WIND CONDITIONS: NUMBER OF LOCATIONS SUITABLE FOR SITTING, STANDING, OR WALKING*

Season	1990 Existing Conditions	1993** New Boston Garden	1995** Interim-Build	2000** Full-Build
Annual	9	16	9	7
Spring	9	16	9	7
Summer	9	18	10	9
Fall	9	16	9	7
Winter	9	16	9	7

* Nine locations tested at periphery of the project site for 1990 Existing conditions: Locations 34, 37-44.
Twenty locations tested at periphery of the project site for 1993 New Boston Garden conditions: Locations 33-44, 72-79.
Twelve locations tested at periphery of the project site for 1995 Interim-Build conditions and 2000 Full-Build conditions: Locations 33-44.

** Pre-mitigation results.

1995 Interim-Build. The proposed 1995 Interim-Build condition reduced the number of locations reporting favorable wind conditions. The number of locations reporting suitable wind conditions during the spring, fall, winter, and annually was nine out of thirteen, with eleven of the locations predicted to have favorable summer wind conditions. Uncomfortable wind activity occurred at the approaches to New Accolon Way during spring (Location 33), summer (Location 37), fall (Locations 33 and 37), winter (Location 33), and annually (Locations 33 and 37). In addition, based on pre-mitigation analysis, uncomfortable wind activity was predicted at the main entrance to the New Boston Garden (Location 42) during the summer season. This wind activity at Location 42 increased to dangerous levels during the spring, fall, winter, and annually. Dangerous wind conditions were predicted to occur at Location 37 during the spring and winter.

2000 Full-Build. In comparison to the 1995 Interim-Build condition, the 2000 Full-Build condition produced fewer locations with wind conditions suitable for sitting, standing, or walking on a seasonal and annual basis. In spring, fall, and annually, the pre-mitigation winds were predicted to be uncomfortable for walking at Locations 31 (fall and annually only), 33, 37, 41, 42 (fall and annually only), and 43. Uncomfortable wind activity during the summer was recorded at Locations 33, 37, and 42. The winter wind activity at Locations 31, 33, 41, and 43 was predicted to be uncomfortable for walking. Dangerous wind conditions were noted at Location 42 in the spring and at Locations 37 and 42 during the winter.

Assessment of Effective Gust Speeds

Table IV-G-9 presents the results of the pre-mitigation wind analysis of effective gusts for all locations studied on and around the New Boston Garden Development site.

Table IV-G-9 NUMBER OF LOCATIONS MEETING THE EFFECTIVE GUST CRITERION*

Season	1990 Existing Conditions	1993** New Boston Garden	1995** Interim-Build	2000** Full-Build
Annual	66	72	60	60
Spring	66	72	59	61
Summer	67	78	71	71
Fall	65	72	62	60
Winter	61	71	55	56

* Sixty-seven locations tested for 1990 Existing conditions: Locations 1-22, 24-32, 34, 37-71.
Seventy-eight locations tested for 1993 New Boston Garden conditions: Locations 1-22, 24-79.
Seventy-one locations tested for 1995 Interim-Build and 2000 Full-Build Conditions: Locations 1-71.

** Pre-mitigation results.

The Technical Data appendix presents the following data: effective gust wind speeds for each of the four seasons, plus annually; annual effective gust speeds for the sensor test conditions at each study location; and a comparative analysis of the effective gust velocities at each location for the four configurations studied.

Existing Conditions. Under Existing conditions, Location 52 exceeded the effective gust criterion on an annual basis and during the spring, fall, and winter. Location 1 exceeded the criterion during the fall and winter seasons. During the winter, Locations 3, 45, 53, and 62 also exceeded the gust criterion.

1993 New Boston Garden. The construction of the New Boston Garden with the elevated Green Line in place resulted in seventy-two of the seventy-eight locations meeting the gust criterion during the spring, fall, and annually while seventy-one locations met the criterion during the winter, and all met the summer gust criterion. Locations 1, 37, 42, 52, 57, and 75 exceeded the 31 mph criterion for the spring, fall, and winter seasons and annually. Location 60 exceeded the gust criterion only under winter conditions.

1995 Interim-Build Condition. Under the 1995 Interim-Build condition, all of the seventy-one locations studied met the gust criterion for the summer. During the spring, fall, and winter seasons, Locations 9, 62, and 55, respectively, met the gust criterion. On an annual basis, sixty of the seventy-one locations met the gust criterion. Locations 1, 23, 27, 29, 37, 42, 52, 55, and 57 exceeded the criterion for the spring, fall, and winter seasons and on an annual basis. In addition, Locations 19, 24, and 31 exceeded the spring and winter criterion; whereas, only Locations 24 and 31 exceeded the criteria on an annual basis.

2000 Full-Build. All seventy-one locations were predicted to meet the 31 mph effective gust criterion during the summer months. Sixty-one locations met the gust criterion in the spring while sixty locations met the criterion for the fall and annually. In the winter, fifty-six locations met the gust criterion. In the spring, fall, winter, and annually, Locations 1, 3, 27, 29, 31, 32, 33, 37, 42, and 57 exceeded the gust criterion. In addition, Locations 5, 43, 52, 55, and 56 surpassed the gust criterion for the winter, and Location 55 exceeded the gust criterion for the fall season.

MITIGATION MEASURES

The results of the pre-mitigation wind tunnel tests have indicated locations of increased wind activity on and around the New Boston Garden Development site as a result of the various on-site and off-site development configurations. The locations subject to increased and unsatisfactory wind conditions are identified above and in the Technical Data appendix. The wind direction(s) having the greatest effect at each location are identified in the Technical Data appendix. With this information, the proposed mitigation measures were developed, tested, and evaluated in the open channel water flume.

Water and wind have similar flow characteristics since both are subject to the laws of fluid dynamics. By submerging the model in the water and introducing a colored dye in the stream flow, the wind flow characteristics in the areas of concern are identified. This enables the development of mitigation measures, using the water flume as a qualitative assessment of their relative effectiveness. Once appropriate measures are developed, the model is retested in the wind tunnel with the mitigation in place. This is conducted to quantify the effectiveness of the mitigation measures. This approach was utilized for the New Boston Garden Development. Following the pre-mitigation tests, portions of the proposed development were revised in accordance with proposed mitigation. Only those locations subject to wind velocity changes resulting from the proposed mitigation were studied. All other locations maintained wind speeds in accordance with the previous tests. The various mitigative measures are identified in the following text.

Remedial devices have been recommended for locations on and around the development site. The use of these devices will assist in creating a comfortable wind environment for the respective pedestrian activities. The type of devices recommended in this report include canopies, trellis work, windscreens, and pennants. A general description of the function of these devices is as follows.

- Canopy. A canopy is used to deflect winds that are intercepted at higher levels above grade and directed downward to pedestrian level. The canopies in question should be constructed approximately 20 to 26 feet above grade and extend a minimum of 12 feet horizontally from the building facade.

- Trellis. A trellis acts as a localized canopy since it disperses vertical wind flow (depending on the porosity of the trellis) and allows pedestrian access at grade level. Trellises, however, are not very effective in mitigating horizontal wind flow at pedestrian level. Trellises should be approximately 40 percent to 60 percent porous to mitigate vertical wind flow.

- Windscreens. Windscreens can be used to mitigate both horizontal and vertical wind action. To effectively disperse the wind, the windscreens suggested for this particular development vary from 20 to 45 feet in height and have a porosity of approximately 40 percent to 60 percent.

- Pennants. The pennants designed for this particular application were very effective in mitigating winds descending from the building facades. The pennants should be approximately 15 feet wide and 50 to 70 feet high, starting approximately 25 to 30 feet above grade.

The type and location of remedial measures being considered for the New Boston Garden Development for the 1993,1995, and 2000 scenarios are as follows (for the purpose of this study, building north is aligned with the rail tracks):

1993 New Boston Garden

During this phase of construction, unacceptable wind conditions attributed to the New Boston Garden Development were predicted at Locations 37, 75, and 79. These wind conditions were subsequently reduced to acceptable wind comfort levels with mitigation. The necessary measures, identified in Figure IV-G-11, were: windscreening at the north end of New Accolon Way, at the east side of New Accolon Way, and at the west side of New Boston Garden and a trellis at the north end of New Accolon Way. The windscreens and other mitigation measures will be designed in consultation with the BRA and GSA.

The wind activity at Locations 42, 80, and 81 identify localized wind conditions which fall in the lower region of the uncomfortable for walking category, but pass the effective gust criterion. The exception is Location 42 which is subject to a gust velocity of 32 mph during the winter season. These wind conditions may be resolved with additional temporary mitigation until the 2000 Full-Build condition reduces the wind impact in these areas. With respect to Location 42, the wind conditions will be improved with the appropriate design and location of the doorway openings in the proposed windscreens.

Uncomfortable wind activity along Causeway Street, Merrimac Street, Lowell Square, and Lomasney Way is attributed to existing wind problems.

1995 Interim-Build

The use of remedial devices was predicted to be effective in reducing wind speeds to acceptable levels at several locations to the southeast and northeast of the development site (i.e., Locations 24, 26, 29, 30, 31, 32, 33, and 37). The remedial devices include: windscreens at the north end of New Accolon Way, at the east side of New Accolon Way, at the west side of New Boston Garden, and at the roof level of the Public Concourse; a trellis at the north end of New Accolon Way and at the southeast corner of Building C; pennants on the east and south sides of Building C; and a canopy at the front of the Public Concourse.

Uncomfortable wind conditions continued at locations along Merrimac Street, Lowell Square, and Lomasney Way, due to winds interacting with existing structures and, to a lesser extent, due to the removal of the elevated Green Line. The uncomfortable wind conditions along Causeway Street (i.e., Locations 16-19, 21, 23, 24, and 27) are predicted to improve in the 2000 Full-Build condition. The increased wind activity along Causeway Street is partially due to the removal of the Green Line and the addition of Building C.

The wind conditions at Location 42 can be improved by appropriate design and location of the doorway openings in the proposed windscreens. This is shown in the test results for the 2000 Full-Build condition. Under this condition, the doors in the windscreens were closed.

2000 Full-Build

The remedial devices which improved wind conditions to acceptable levels of comfort for this phase of the development are: windscreens at the north end of New Accolon Way, at the east side of New Accolon Way, at the west side of New Boston Garden, at the south side of Building A, and at the roof level of the Public Concourse; a trellis at the north end of New Accolon Way and at the southeast corner of Building C; pennants on the northeast corner of New Boston Garden and on the east end and south sides of Building C; and a canopy at the front of the Public Concourse.

Uncomfortable wind conditions on Causeway Street at Locations 5, 31, and 32 are attributed to the construction of the Portland Place development (Location 5) and the dismantling of the portions of the elevated Central Artery (Locations 31 and 32). The uncomfortable wind activity along Merrimac Street, Lowell Square, and Lomasney Way (Locations 55, 56, and 57) is attributed to the addition of the proposed Lowell Square development.

Locations 28 and 80 are subject to conditions considered uncomfortable for walking. This occurs during the spring, fall, winter, and annually at Location 28 and only during the winter at Location 80. These locations, however, meet the BRA gust criterion under all circumstances. Additional localized mitigation will be required to help improve wind conditions at these locations.

Table IV-G-10 presents the pre- and post-mitigation wind analysis results of all test locations, under all four study conditions, which were considered comfortable for sitting, standing, or walking. Table IV-G-11 identifies the pre- and post-mitigation locations, under all four study conditions, which met the BRA Effective Gust criterion.

In general, the 1993 New Boston Garden condition had the least impact on the existing wind conditions of the three proposed Build conditions.

The 1995 Interim-Build condition created an increase in wind activity on and around the development site, i.e., along Causeway Street between Friend Street and Medford Street, between New Accolon Way and the Central Artery, along the Merrimac Street connector between Merrimac Street and Lynott Street, and in the alley between the GSA Building and the New Boston Garden.

Table IV-G-10 NUMBER OF LOCATIONS SUITABLE FOR SITTING, STANDING, OR WALKING*

Season	1990 Existing Conditions	1993 New Boston Garden	1993 With Mitigation	1995 Interim-Build	1995 With Mitigation	2000 Full-Build	2000 With Mitigation
Annual	63	66	74	56	64	54	67
Spring	62	65	73	47	62	54	67
Summer	66	73	80	65	77	63	73
Fall	62	66	73	52	64	54	67
Winter	59	63	70	47	59	52	66

* Sixty-seven locations tested for 1990 Existing conditions: Locations 1-22, 24-32, 34, 37-71.
Seventy-eight locations tested for 1993 New Boston Garden conditions: Locations 1-22, 24-79.
Eighty-one locations tested for 1993 New Boston Garden with mitigation: Locations 1-22, 24-82.
Seventy-one locations tested for 1995 Interim-Build and 2000 Full-Build conditions: Locations 1-71.
Seventy-nine locations tested for 1995 Interim-Build with mitigation: Locations 1-73, 75, 76, 79-82.
Seventy-seven locations tested for 2000 Full-Build with mitigation: Locations 1-72, 75, 79-82.

Table IV-G-11 NUMBER OF LOCATIONS MEETING THE EFFECTIVE GUST CRITERION*

Season	1990 Existing Conditions	1993 New Boston Garden	1993 With Mitigation	1995 Interim-Build	1995 With Mitigation	2000 Full-Build	2000 With Mitigation
Annual	66	60	79	60	76	60	71
Spring	66	72	79	59	74	61	71
Summer	67	78	81	71	79	71	77
Fall	65	72	79	62	75	60	71
Winter	61	71	77	55	72	56	69

* Sixty-seven locations tested for 1990 Existing conditions: Locations 1-22, 24-32, 34, 37-71.
Seventy-eight locations tested for 1993 New Boston Garden conditions: Locations 1-22, 24-79.
Eighty-one locations tested for 1993 New Boston Garden with mitigation: Locations 1-22, 24-82.
Seventy-one locations tested for 1995 Interim-Build and 2000 Full-Build conditions: Locations 1-71.
Seventy-nine locations tested for 1995 Interim-Build with mitigation: Locations 1-73, 75, 76, 79-82.
Seventy-seven locations tested for 2000 Full-Build with mitigation: Locations 1-72, 75, 79-82.

The 2000 Full-Build condition reduced the wind activity to acceptable levels at several locations along Causeway Street when compared to the 1995 Interim-Build condition. Wind speed increases considered uncomfortable for walking, were predicted to occur along Causeway Street between Haverhill Street and Medford Street, between New Accolon Way and the depressed Central Artery, and between the GSA Building and the New Boston Garden Development.

CONCLUSION

Mitigating measures designed to reduce the uncomfortable and dangerous wind conditions at the aforementioned locations were developed and tested in a wind tunnel for the various development test conditions. The mitigation measures include: pennants, windscreens, trellises, and canopies strategically located on and around the proposed structures. Significant wind speed reductions were recorded at several areas of concern as a result of the implementation of the mitigation measures. In certain areas, changes to the existing wind environment were attributed to the construction of other proposed developments and/or the removal of existing structures, such as the elevated Green Line and portions of the elevated Central Artery. There were also a limited number of locations subject to wind speeds considered uncomfortable for walking for various seasons of the year. Generally, these locations met the effective gust criterion. Further mitigation will be examined for these locations. Overall, the proposed mitigation measures have proven to be very effective.

H Shadow

INTRODUCTION

A series of computer-generated shadow analyses have been conducted for the New Boston Garden Development to predict and evaluate project-generated shadows. The analyses focus on shadow effects on: the site, major pedestrian areas, and existing and proposed public open spaces such as the Metropolitan District Commission (MDC) parkland along the Charles River and the New Charles River Dam. Seasonal studies were conducted for the vernal equinox (March 21), summer solstice (June 21), autumnal equinox (September 21), and winter solstice (December 21) for morning, midday, and afternoon shadow effects. As directed in the Boston Redevelopment Authority (BRA) scope, the shadow analysis identifies the incremental impact of the proposed project buildings on the study area through a determination of net new shadows in the context of the existing shadows cast by surrounding buildings. The elevated Green Line structure is not included in either the existing or future conditions.

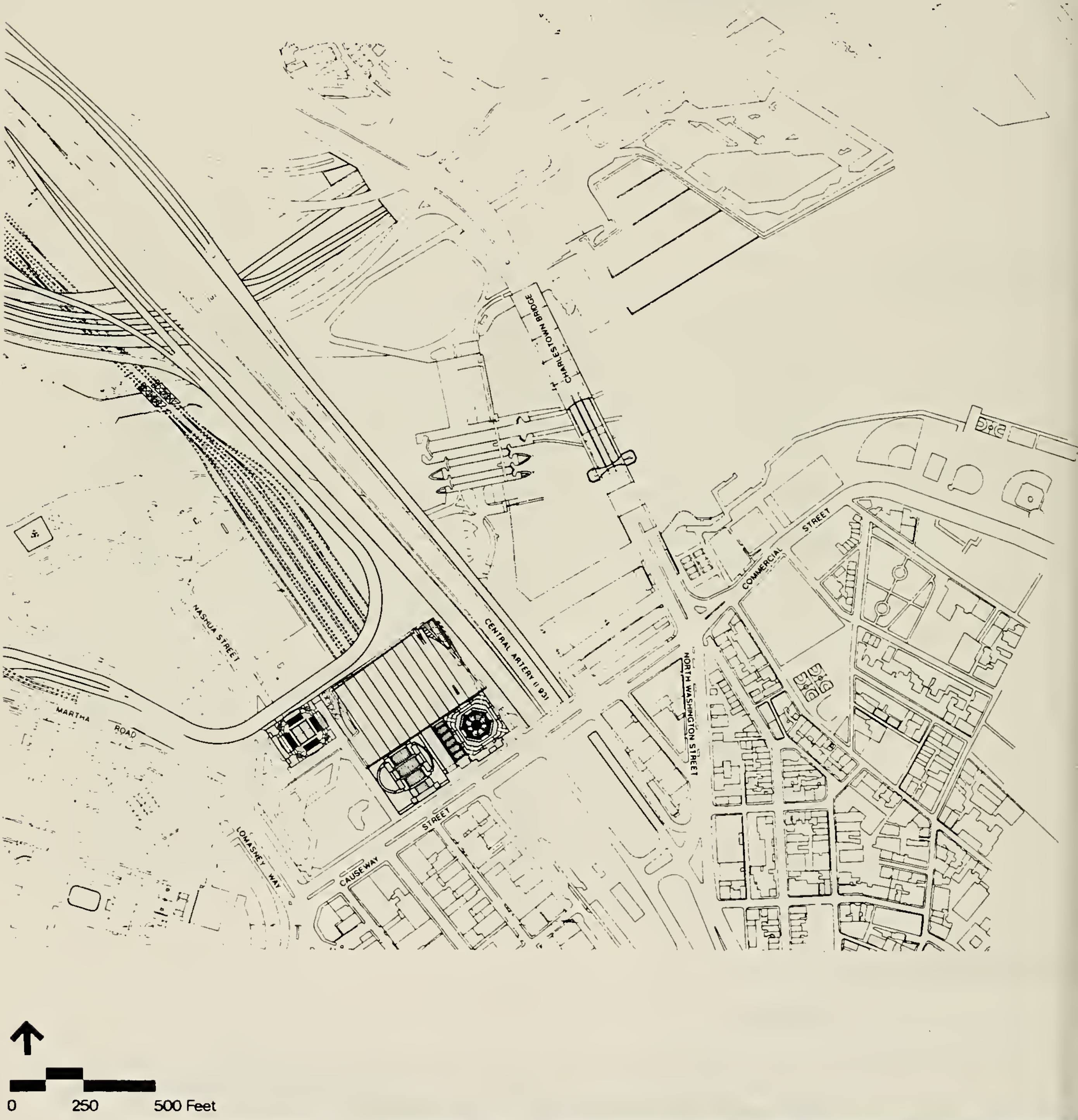
The shadow analyses indicate that, in general, the majority of project shadows will be cast on the surrounding public roadways and on the commuter rail tracks to the north of the site. During spring, fall, and winter mornings, shadows will be cast near the institutional buildings to the northwest of the site. Shadow effects on the MDC parklands along the Charles River are minimal, with new shadows predicted to extend to the waterfront in the vicinity of the Spaulding Rehabilitation Hospital only on winter mornings. Portions of the New Charles River Dam and the pedestrian walkway which crosses it are predicted to be in shadow during late winter afternoons. There will be no shadow impacts to the Bulfinch Triangle Historic District or the North End.

METHODOLOGY

Study Area

The study area for this shadow analysis is generally bounded by Leverett Circle to the west, the Charles River to the north, the mouth of the Charles River to the east, and the Bulfinch Triangle area to the south (see Figure IV-H-1).

Consideration is given to the sidewalks surrounding the site, as well as existing and proposed major public spaces and parklands in the study area. These areas are described below:



Vanasse Hangen Brustlin, Inc.

Shadow Study Area

Figure IV-H-1

- New Charles River Dam and locks operated by the MDC, including a pedestrian walkway which is part of the Paul Revere Landing Park described below.

- MDC Paul Revere Landing Park located on both sides of the Charles River and linked by a walkway over the New Charles River dam locks. The south bank portion is located beneath the Central Artery bridge, and while this area has a riverside walkway and picnic facilities, it is highly inaccessible. The Charles River Dam walkway serves as a pedestrian crossing between Charlestown and Causeway Street. The north bank portion of Paul Revere Landing Park will be expanded and enhanced as part of the Central Artery North Area (CANA) construction mitigation package.

- North End MDC recreation facilities facing Boston Harbor.

- Proposed extension to the Esplanade on designated MDC Parkland north of Nashua Street.

- A proposed urban park that will be created at the portal of the depressed Central Artery north of Causeway Street to the east of the project site.

Consideration is also given to shadow impacts to the historic U.S.S Constitution ("Old Ironsides") moored at the Charlestown Navy Yard.

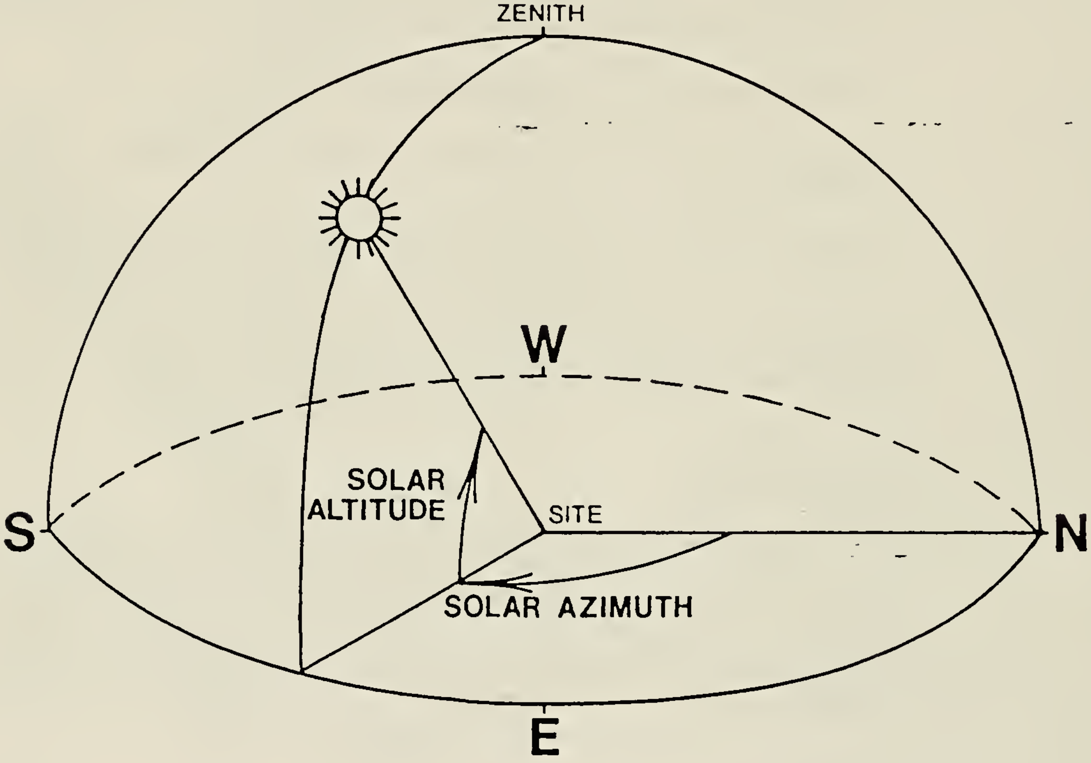
Shadow Analyses

Shadow lengths and locations are dependent upon structure height and massing, building location, and the location of nearby structures, as well as topography, time of day, and the sun's position relative to the earth. For purposes of this study, shadows were cast in the ground plane. The sun's position is established by calculating various angles which are dependent upon the time of analysis and the earth's orbit, as discussed below.

Sun Angles

As the earth orbits in an elliptical pattern around the sun, the angle of its rotation varies over the year, causing the sun to appear at different positions in the skydome. In the Northern Hemisphere, the sun is at its highest point in the sky during the summer months, peaking on the summer solstice (July 21). The sun moves southward (toward the equator) relative to the northern hemisphere as fall approaches, and is nearly even with the equator during the autumnal equinox (September 21). During the winter, the sun dips below (south of) the equator, reaching its lowest point on the winter solstice (December 21), at which point it begins to move back toward the equator, reaching the equator again on the vernal equinox (March 21). The sun's position relative to the equator is the same for both the autumnal equinox and the vernal equinox.

Because the sun's position as it appears in the northern hemisphere is highest at the summer solstice, shadows are shortest at this time. March and September shadows represent average shadow conditions, while shadows are longest at the winter solstice, when the sun is at its lowest position in the sky.



Source: *Sun Angles for Design*, Robert Bennett,
Bala Cynwyd, PA, 1978.

Vanasse Hangen Brustlin, Inc.

Solar Angles

Figure IV-H-2

The sun's position in the sky relative to any particular location on earth is designated by two angles:

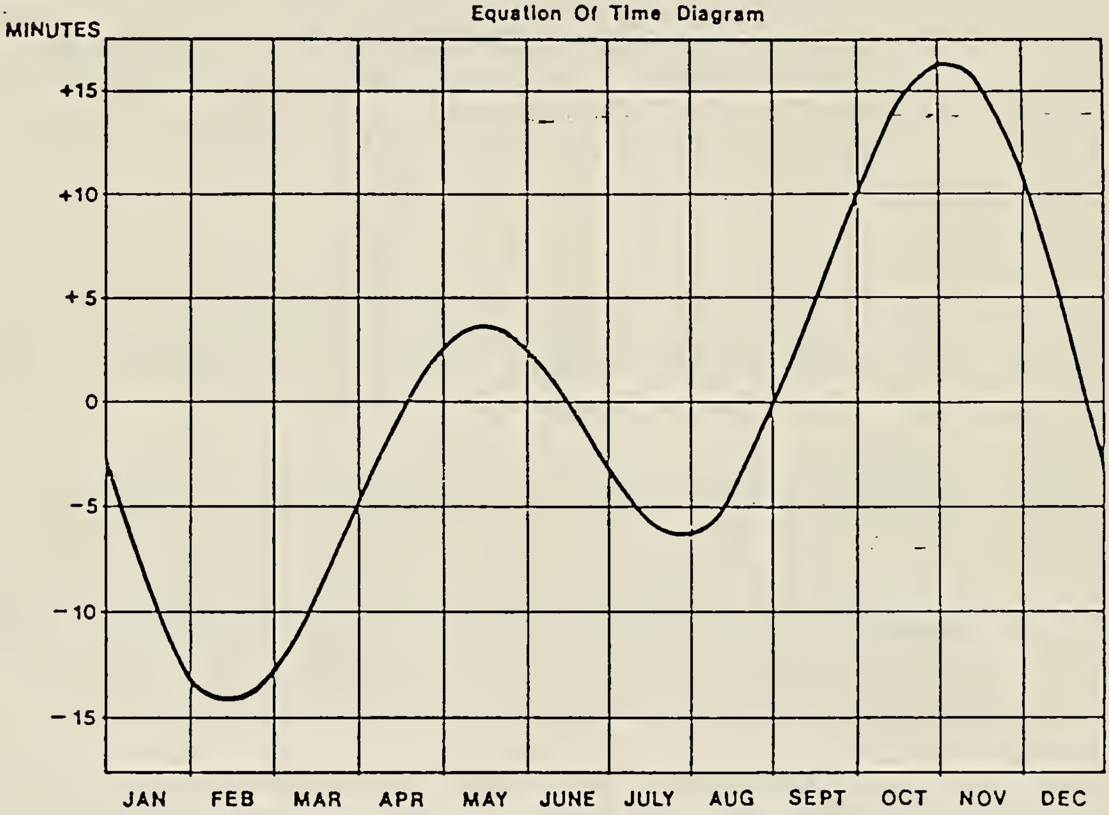
- "Solar altitude" is the angle measured from the horizon up to the sun (see Figure IV-H-2). When the sun is on the horizon, this angle equals 0 degrees, and when the sun reaches its zenith, this angle equals 90 degrees.
- The angle which measures the distance between north and the sun's projection on the horizon is called the "solar azimuth" and is measured clockwise from the north direction. This angle equals 0 degrees at north, 90 degrees at east, 180 degrees at south, 270 degrees at west, and 360 degrees at north to complete the full circle. Solar azimuth is measured from "true" or "geographic" north, versus magnetic north (the direction toward which a compass points). The difference between true north and magnetic north varies annually and can be substantial (greater than 20 degrees).

Time

Time is an important variable in calculating the sun's position. In conducting accurate shadow analyses, it is necessary to calculate solar time (versus clock time). For the New Boston Garden Development, several factors associated with time were considered, as discussed below.

Clock Time. Clock time is the standard measurement used to denote time. A total of twenty-four standard time zones have been established, representing the 24 hours required for the earth to complete a rotation. Because the earth rotates 15 degrees every hour, time zones encompass approximately 15 degrees of longitude, with each time zone associated with a central longitude. The longitudinal lines used to establish time zones are referred to as meridians, with the Greenwich, England meridian used as the prime basis of standard time throughout the world (i.e., the Greenwich meridian represents 0 degrees longitude).

- The Eastern Standard Time Zone is associated with the central longitude of 75 degrees, and it includes the eastern portion of the United States. This time zone lies five meridians (each of 15 degree intervals) to the west of the Greenwich meridian (0 degrees longitude), representing a five-hour time difference between this zone and Greenwich, England.
- Daylight Savings Time (DST) is in effect in North America from the first Sunday in April to the last Sunday in October. Although initially instituted on a local basis during World War I in the industrial areas of the North to conserve fuel, it was nationally instituted after World War II to provide city dwellers with an additional hour of daylight for activities after work. In the spring, clocks are advanced ahead one hour to Daylight Savings Time. In the fall clocks are set back one hour, returning to Eastern Standard Time. Both the vernal equinox and the summer solstice occur while Daylight Savings Time is in effect. Although the earth is in a similar orbit during both the vernal equinox and the autumnal equinox, measurements of the sun's position vary by one hour because Daylight Savings Time is in effect for the autumnal equinox.



Source: *Sun Angles for Design*, Robert Bennett,
Bala Cynwyd, PA, 1978.

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Equation of Time

Figure IV-H-3

Solar Time. When calculating sun angles for shadow analyses purposes, it is necessary to use solar time, rather than clock time, to accurately calculate the sun's position at any given time. Solar time is derived by adjusting clock time for: (1) site distance from the local standard meridian; (2) Daylight Savings Time; and (3) seasonal changes in the earth's orbiting pattern, referred to as the "equation of time."

Clock time for standard time zones is associated with a central longitude, therefore, it is necessary to account for variation in the sun angles for sites which do not lie directly along the central longitude. The New Boston Garden Development site lies within the Eastern Standard time zone whose standard meridian is at 75 degrees longitude. The project site itself is located at a longitude of approximately 71 degrees. Solar time varies from clock time by approximately 4 minutes for every degree of longitude. Thus, for every degree of longitude a site lies to the east of the central longitude, 4 minutes are added to clock time to derive solar time, while for every degree to the west, 4 minutes are subtracted from clock time. Depending upon the location being studied, solar time can vary from clock time by 30 minutes or more.

Equation of Time. As the earth orbits around the sun, seasonal variations occur in the geometry of their relative positions, affecting solar time. In order to accurately derive solar time, a corrective factor is applied. This factor is referred to as the "equation of time," as shown in Figure IV-H-3.

ANALYSIS CONDITIONS

A series of computer-generated shadow analyses have been conducted to compare and evaluate existing and proposed project shadows. These analyses are shown at the end of this chapter in Figures IV-H-4 through IV-H-15 for twelve analysis conditions. The Figures show the combined shadow impacts for the existing and future conditions in order to clearly demonstrate the location of net new shadows. The darkly shaded areas represent net new shadows cast by the proposed project buildings. The lighter shaded areas represent the shadows cast by buildings existing in both 1990 and 2000.

Existing Conditions

Under Existing conditions, Boston Garden and 150 Causeway Street are the only buildings on the project site. Major buildings or structures that cast significant shadows in the study area include: the General Services Administration (GSA) Building; the approximately 400-foot tall Longfellow Place towers, Whittier Place, and other buildings at Charles River Park; the Spaulding Rehabilitation Hospital; the Suffolk County Jail; the Commonwealth of Massachusetts Registry of Motor Vehicles; and the elevated Central Artery and ramps.

2000 Full-Build Conditions

Under 2000 Full-Build conditions, the New Boston Garden, Buildings A, B, and C, and the Public Concourse are scheduled to be complete. Demolition of 150 Causeway Street will have occurred as part of the Central Artery project. It is assumed that the following major projects in the study area will have been built by this analysis year: Lowell Square, a 235-foot housing development at the intersection of Lomasney and Merrimac Streets; Massachusetts General Hospital building (MGH), a 150-foot building located off Nashua Street; and Portland Place Phase II, a six-story building in the Bulfinch Triangle area.

PROBABLE PROJECT IMPACTS

Project-related shadow impacts are discussed for the Full-Build condition (2000) in relation to the net new shadows created as part of the New Boston Garden Development. Impacts of the Full-Build condition are graphically identified in the shadow analyses Figures (Figures IV-H-4 through IV-H-15) at the end of this section.

March 21, Vernal Equinox (EST)

9:00 AM

During spring mornings, on-site shadows cast by the proposed project are on the public walkway between the New Boston Garden and the GSA Building and Building A. There is existing shadow, cast by the GSA Building on the walkway between Building A and the GSA Building. Off-site, shadows are cast by the project on sidewalks on either side of Nashua Street and on Nashua Street pavement; on a portion of the public plaza in front of the Registry of Motor Vehicles; and areas north of the project including the commuter rail tracks, the proposed MGH building, and portions of the Central Artery.

Noon

Spring shadows at midday are oriented to the north, resulting in project-related shadows cast on portions of the public walkway between Building A and the New Boston Garden and on a small area north of the Central Artery ramps. A small portion of the sidewalk of Revere Park and the proposed Central Artery portal will be shaded.

3:00 PM

During springtime afternoons, shadows will be oriented toward the east. Project shadows will be cast on the public walkway between the New Boston Garden and Building A. Off-site shadows include: a small portion of shadow on the proposed ferry landing in the vicinity of Lovejoy Wharf; on the sidewalks between the Hoffman and Stop & Shop buildings; a portion of the proposed Central Artery portal; and across North Washington Street. There is partial shading of the north sidewalk of Causeway Street.

June 21, Summer Solstice (EDT)

9:00 AM

During the summer solstice, project shadows are cast in a westerly direction. On-site shadows are cast on the pedestrian walkway between New Boston Garden and Building A, a portion of the sidewalk in front of Building A, and on the service area north of the New Boston Garden. New shadows off-site are cast on a small portion of Nashua Street and on the sidewalk on the north side of Nashua Street.

Noon

Project shadows will be shortest for the twelve analysis conditions at noon on the summer solstice. Minimal shading will occur, and virtually all shadows will be contained on-site except for a small portion which will shade the Central Artery ramps north of the site. The entire pedestrian walkway between Building A and the New Boston Garden will be in sunlight.

3:00 PM

Afternoon shadows during the summer will shade parts of the pedestrian walkway to the Charles River. There will be partial shading of the northern sidewalk of Causeway Street, and of the proposed Central Artery portal to the east of the site. New shadow will be cast on the pedestrian walkway between the New Boston Garden and Building A; the remainder of the public walkway between Building B and the GSA Building will be in shadow cast by the GSA Building.

September 21, Autumnal Equinox (EDT)

9:00 AM

Project shadows will be oriented to the northwest during fall mornings. These shadows are predicted to extend across a small portion of the walkway between the New Boston Garden and Building A, and onto Nashua Street including portions of both sidewalks. New shadow is cast on an area behind the Registry of Motor Vehicles adjacent to the Central Artery ramps. In addition, new shadows will fall in the area north of the Central Artery ramps in the vicinity of the proposed MGH building and the commuter rail tracks.

Noon

Noontime shadows will be oriented to the north for fall conditions. Net new project shadows will be limited to a small portion of the pedestrian walkway between the New Boston Garden and Building A, a portion of the MGH property to the north of the Central Artery ramps, and a small area on the northeast corner of the New Boston Garden. The remainder of the pedestrian walkway between Building A and the New Boston Garden is in shadow from the GSA Building.

3:00 PM

Project shadows will be oriented to the northeast. On-site shadows will be cast on the pedestrian walkway between Building A and the New Boston Garden, while the remainder of the public walkway will be in shadow from the GSA Building. New shadow will be cast on the pavement and northern sidewalk between the Hoffman and Stop & Shop buildings.

December 21, Winter Solstice (EST)

9:00 AM

On the winter solstice, morning shadows are long due to the sun's low position in the sky. Partial shading of the walkway between the New Boston Garden and Building A is predicted to occur. Project shadows will fall on portions of Nashua Street, including the eastern sidewalk in front of the Spaulding Rehabilitation Hospital. Shadows will fall on a small portion of the proposed waterfront park area which is part of the planned Esplanade extension, and will extend to parts of the Charles River. New shadows will fall on the commuter rail tracks, the bridge, and the Central Artery ramps to the north of the site.

Noon

During winter afternoons, shadows will be oriented to the north. Shadows from the GSA Building will shade the pedestrian walkway between the New Boston Garden and Building A. Shadows from the project are predicted to extend to the commuter rail tracks to the north of the site and to portions of the New Charles River Dam, the locks, and Revere Park.

3:00 PM

Shadows will be longest during the late afternoon of the winter solstice. These shadows represent the worst-case analysis for the entire year. Shadows cast by the proposed project are in a northeasterly direction. On-site shadow impacts are minimal and include only a portion of the service area to the north of New Boston Garden. Winter shadows will be cast on the proposed ferry landing area and portions of the New Charles River Dam and pedestrian crossing. Shadows are also predicted to fall on the North Washington Street Bridge and on open water at the mouth of the Charles River, extending across to Pier 1 at the Charlestown Navy Yard.

Additional analysis was conducted to assess the shadow impacts on the U.S.S. Constitution, which is moored in the Charlestown Navy Yard (See Section IV-E, Historic Resources). Based a seasonal analysis, it is predicted that shadows may sweep the U.S.S Constitution in the winter months for a few minutes in the late afternoon.

MITIGATION MEASURES

Mitigation measures for shadow effects were incorporated into the conceptual design of the New Boston Garden and the commercial component. These consist mainly of considerations of building height, massing, location, and orientation. For the New Boston Garden Development project, the proponent has incorporated the following site considerations affecting shadow conditions:

- Building heights are varied to limit the potential impact from close, densely massed buildings.

- Buildings A, B, and C have been designed to maximize sunlight conditions for pedestrian areas for midday and afternoon periods by means of setbacks in the forms of the structures.

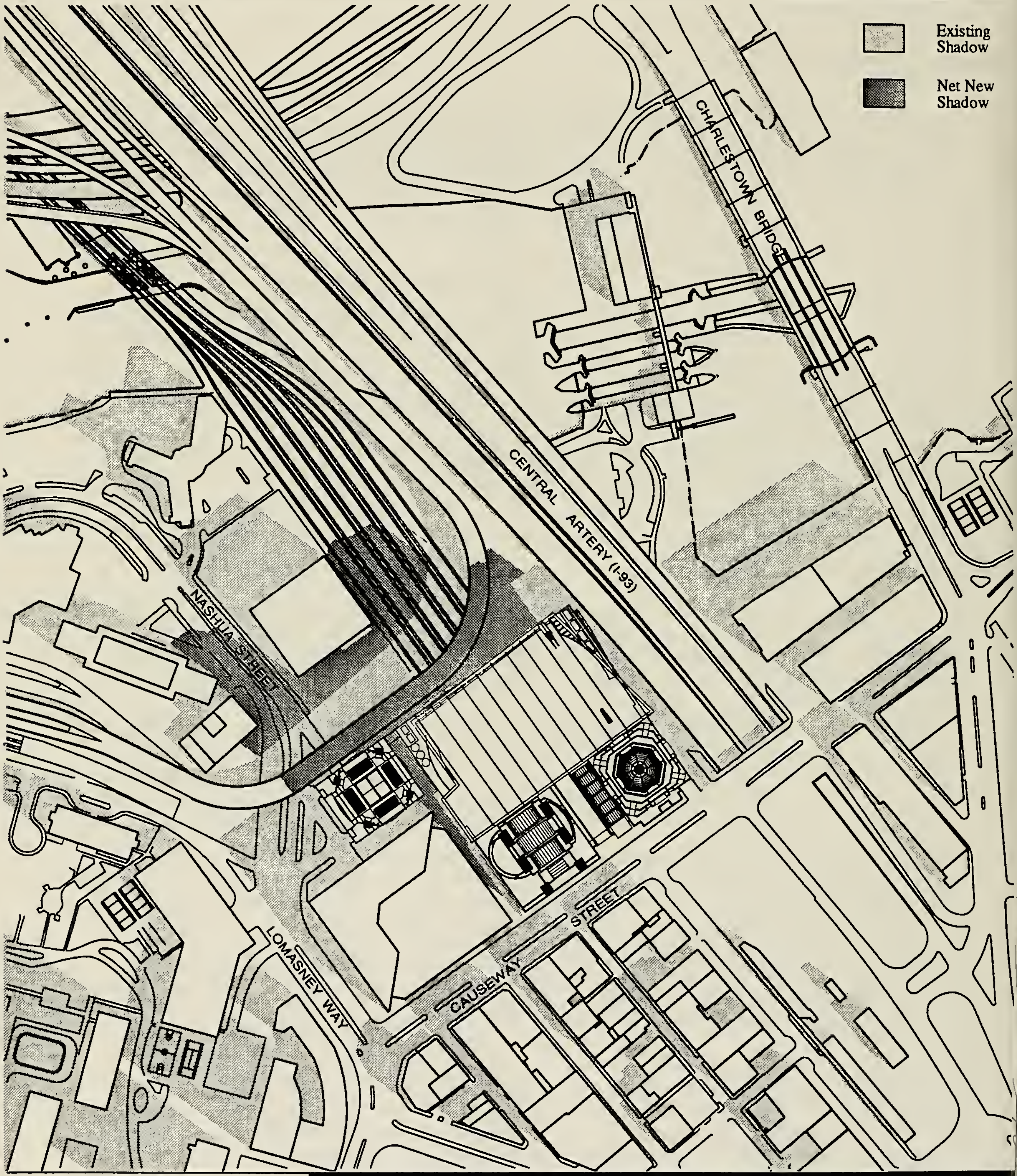
- All building setbacks as required by zoning have been observed.

Overall, the minimal shadow effects of the project are the result of its siting relative to the City of Boston and the proximity of tall buildings in the project area.

CONCLUSION

The majority of on-site shadows are predicted to fall on the pedestrian walkway between the New Boston Garden and Building A. The remainder of the public walkway will be in shadow cast by the GSA Building. The north sidewalk on Causeway Street will be in shadow during spring and summer afternoons.

Project shadows will extend to the north of the Central Artery ramps in the vicinity of the institutional buildings in that area. Shadow impacts on the Charles River Dam, the locks, and the proposed ferry landing are minimal and will be limited to winter afternoons. The Bulfinch Triangle area and sidewalks on the south of Causeway Street will not be affected by project shadows.



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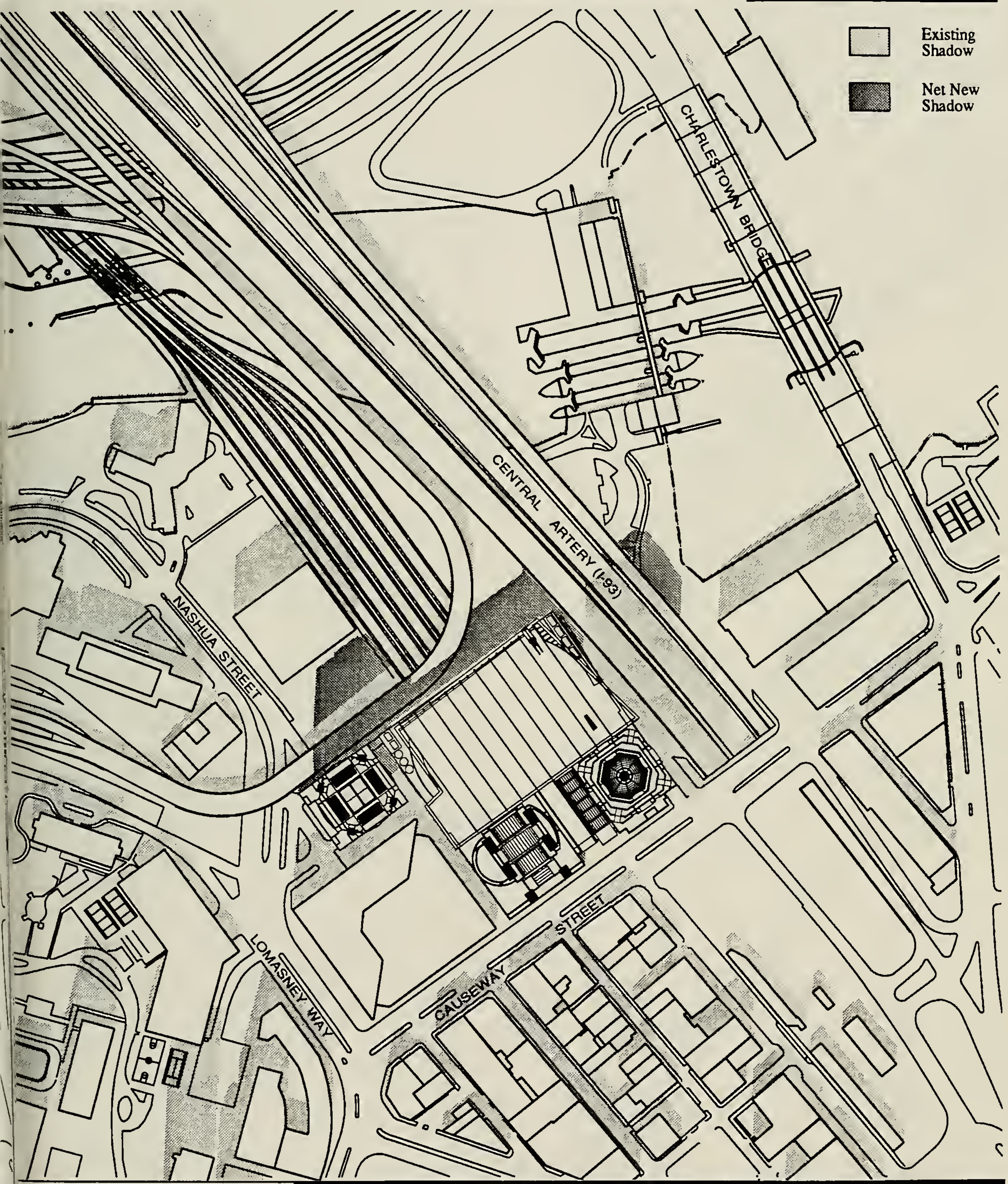
Shadow Condition
March 21; 9:00 AM

Figure IV-H-4



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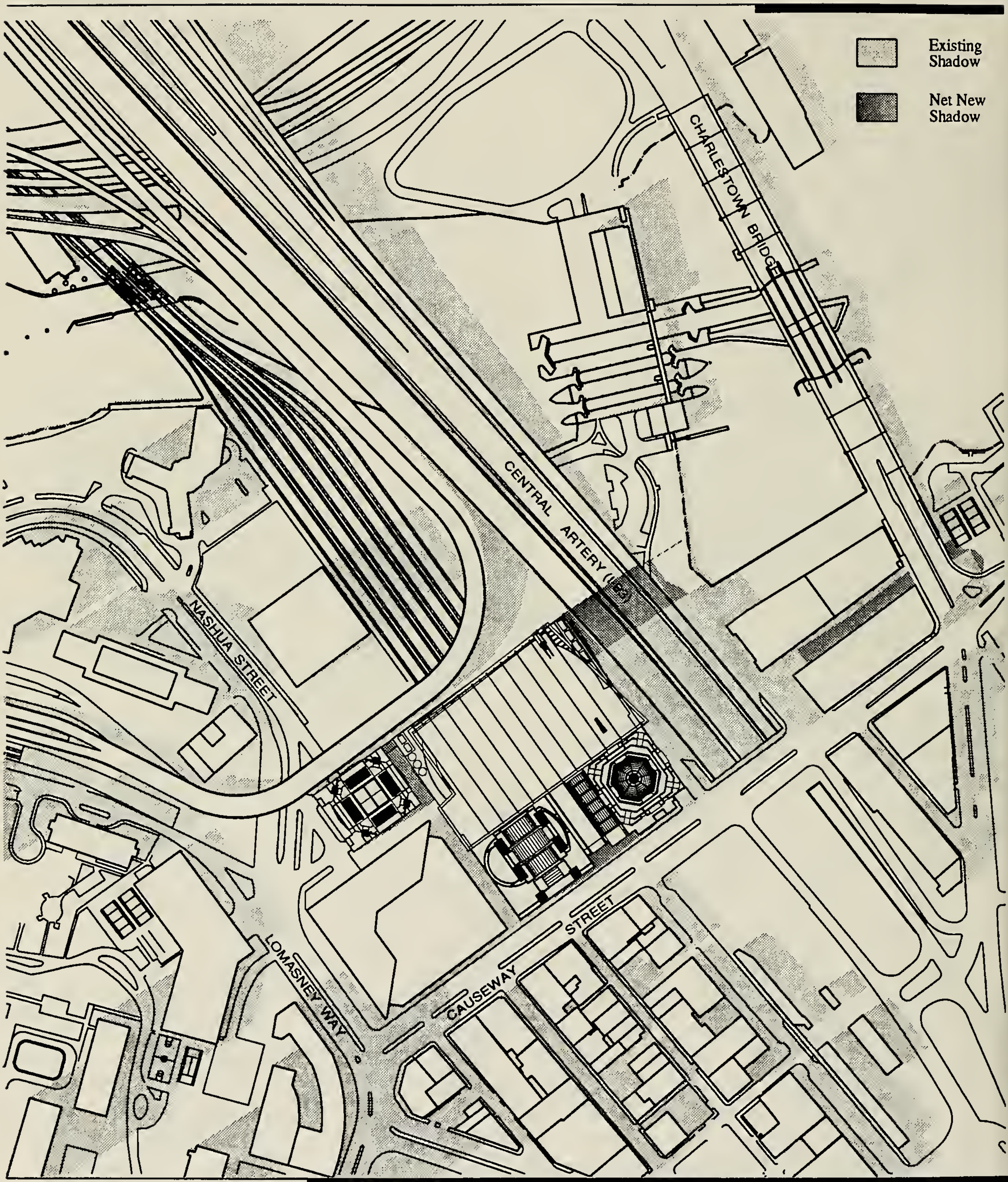
Shadow Condition
March 21; 12:00 Noon

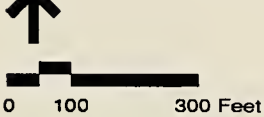
Figure IV-H-5

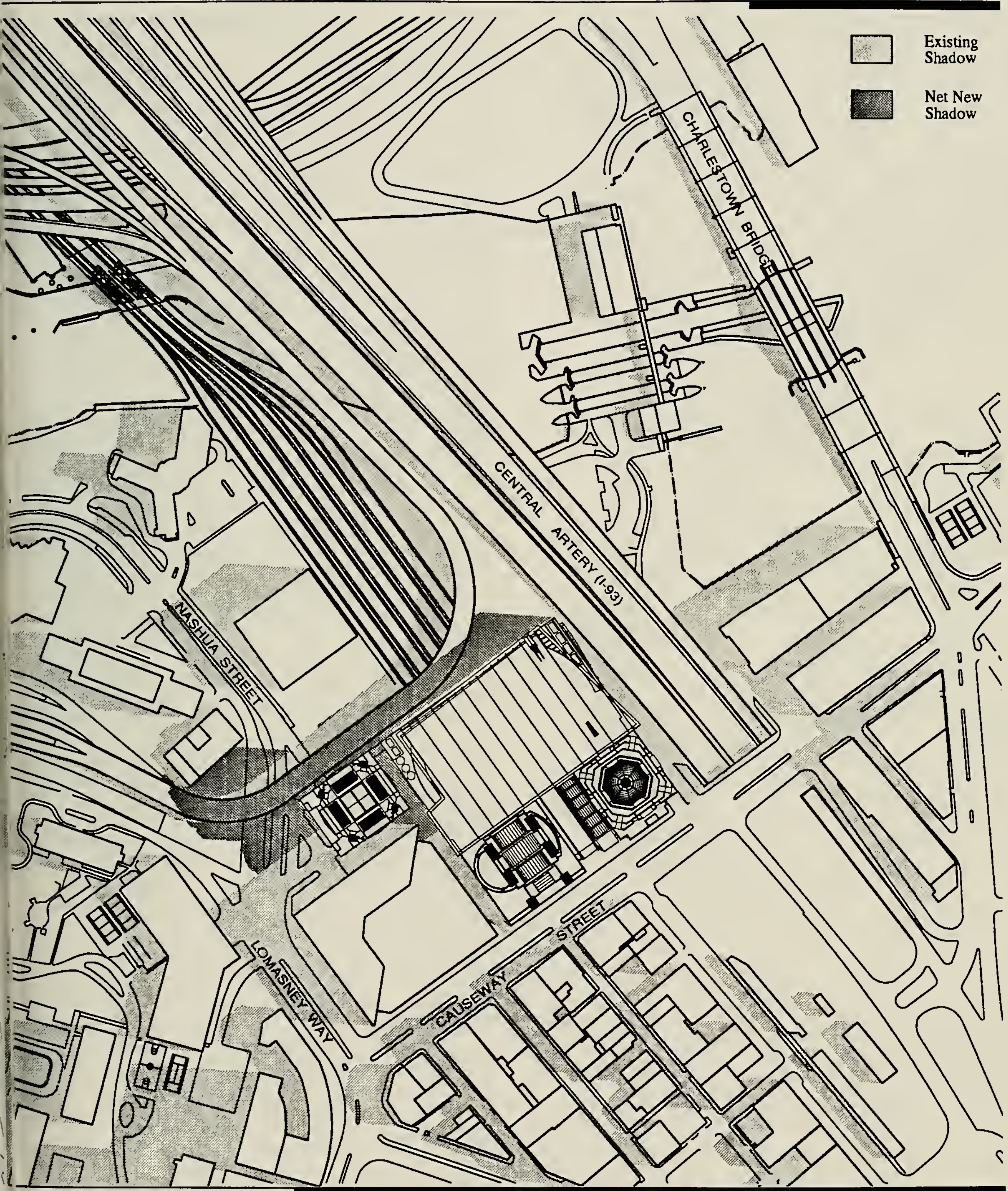


Vanasse Hangen Brustlin, Inc.

Shadow Condition
March 21; 3:00 PM

Figure IV-H-6





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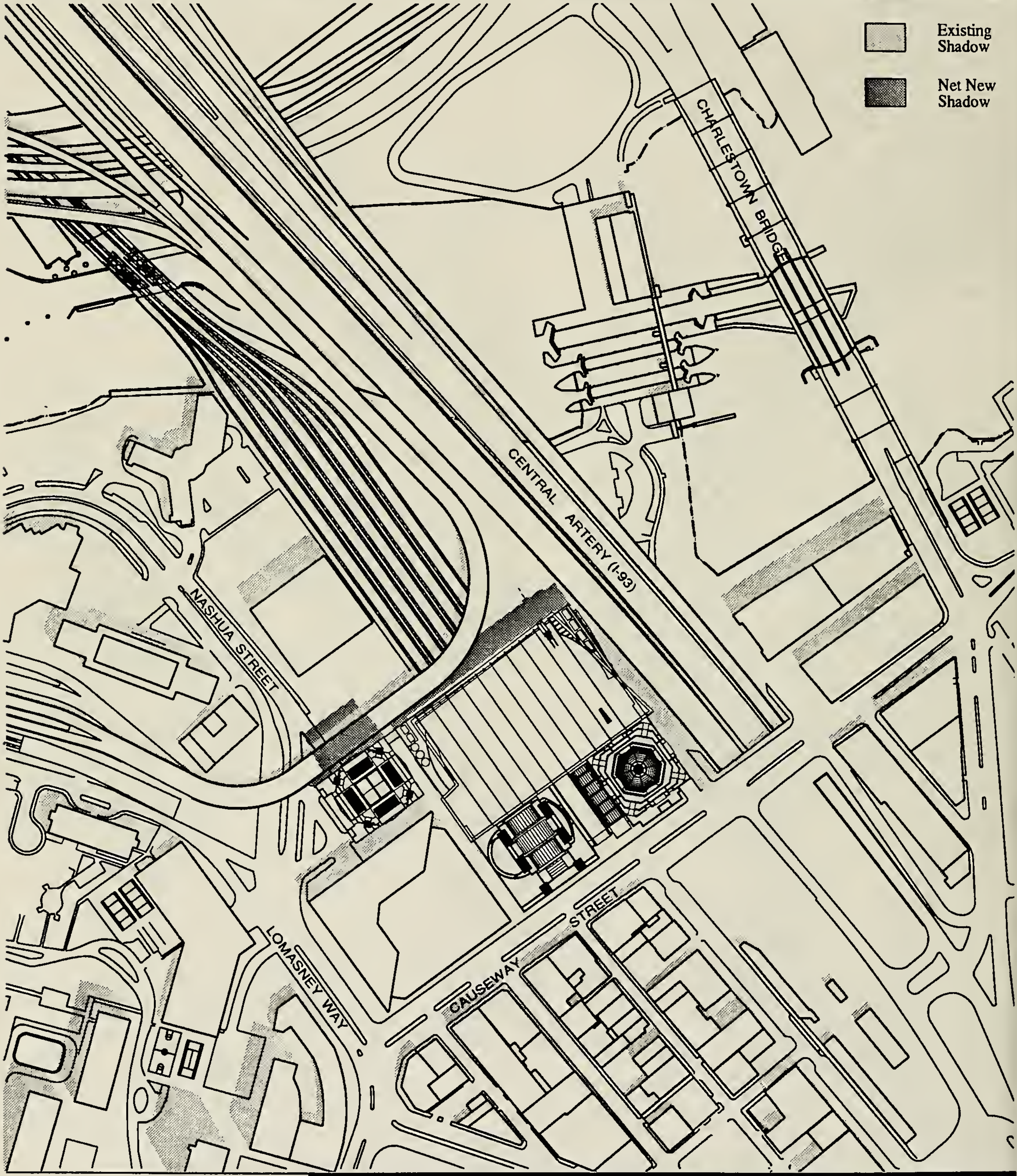
Shadow Condition
June 21; 9:00 AM

Figure IV-H-7

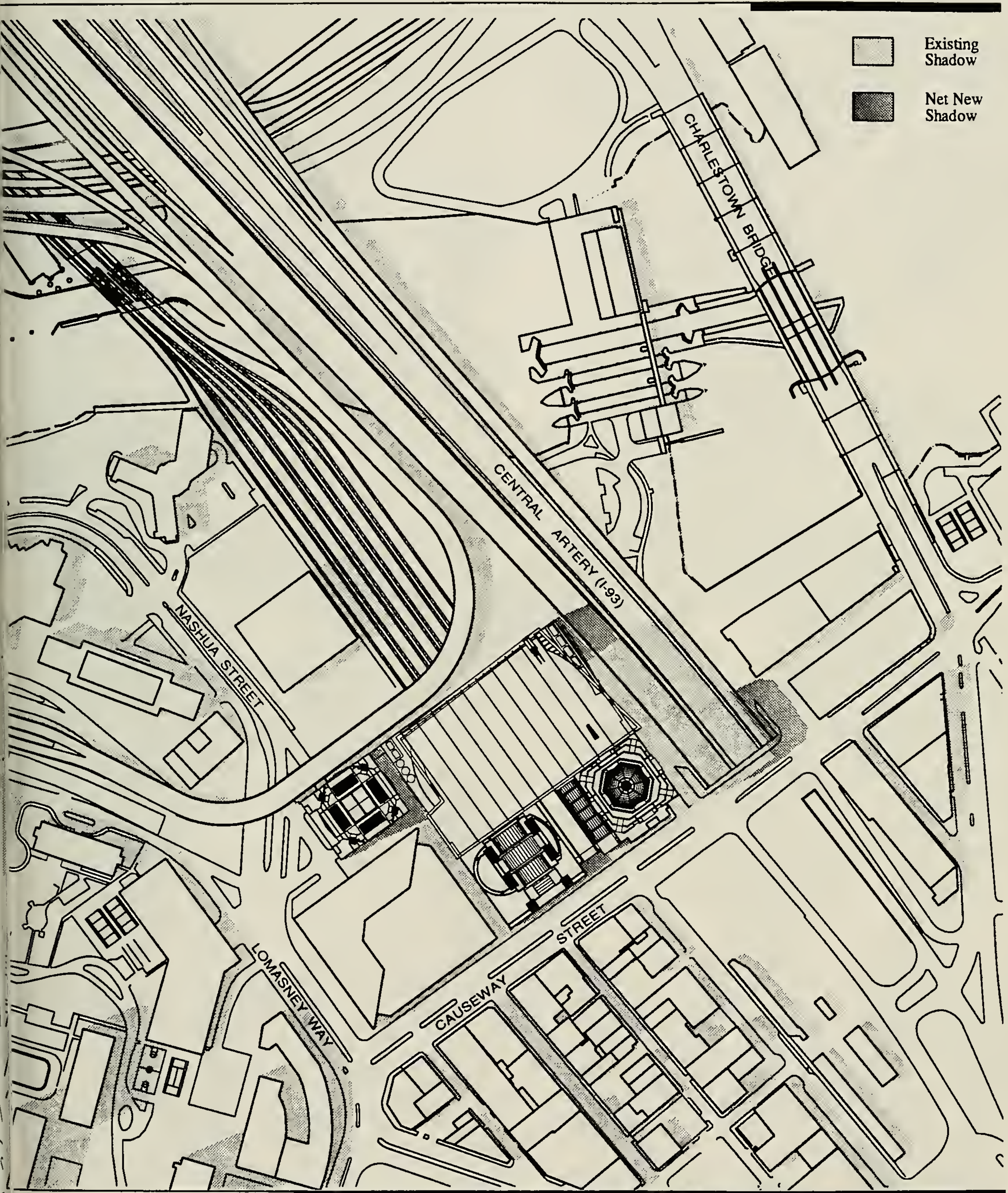
100 300 Feet



Vanasse Hangen Brustlin, Inc.

Shadow Condition
June 21; 12:00 Noon

Figure IV-H-8



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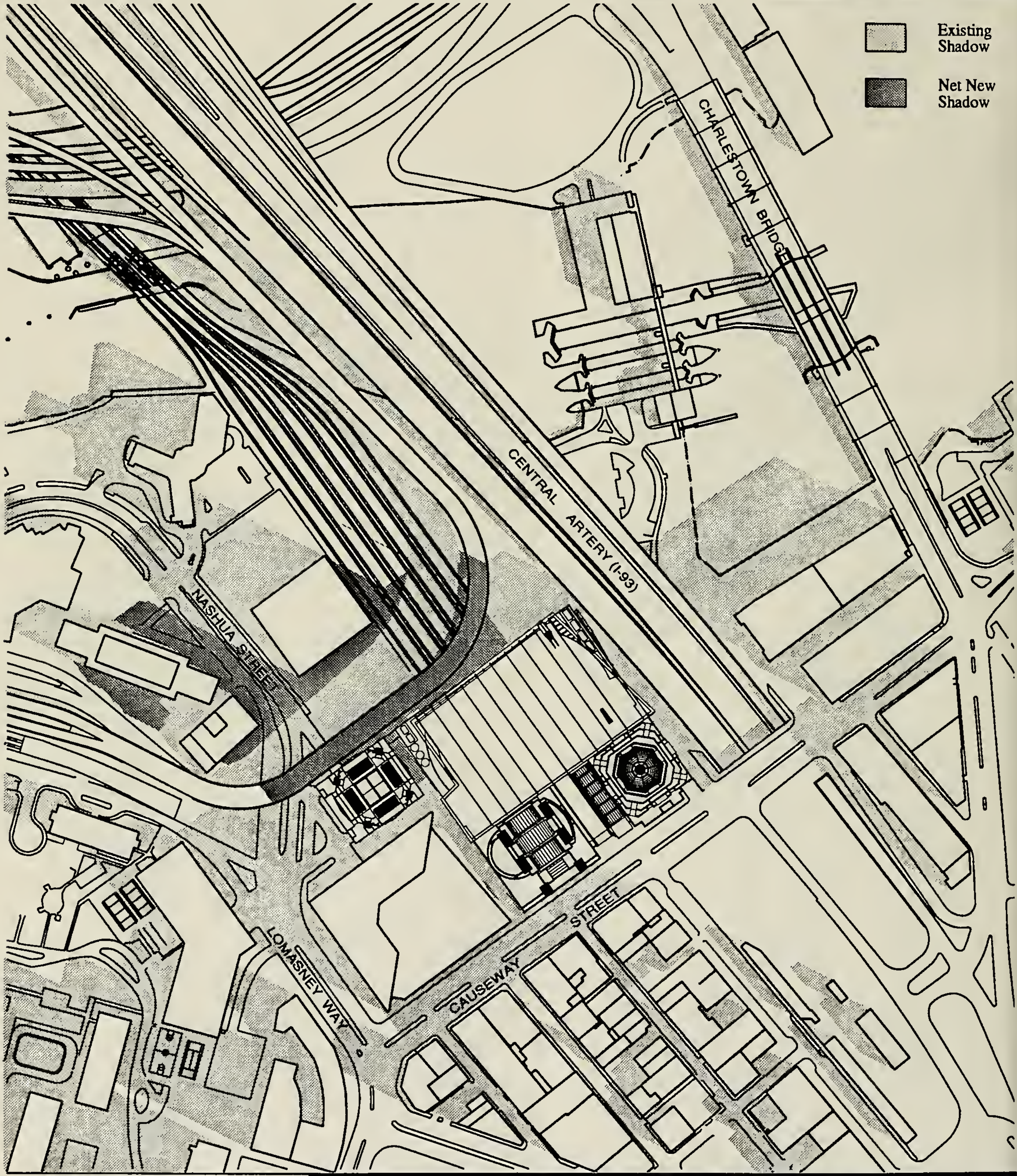
Shadow Condition
June 21; 3:00 PM

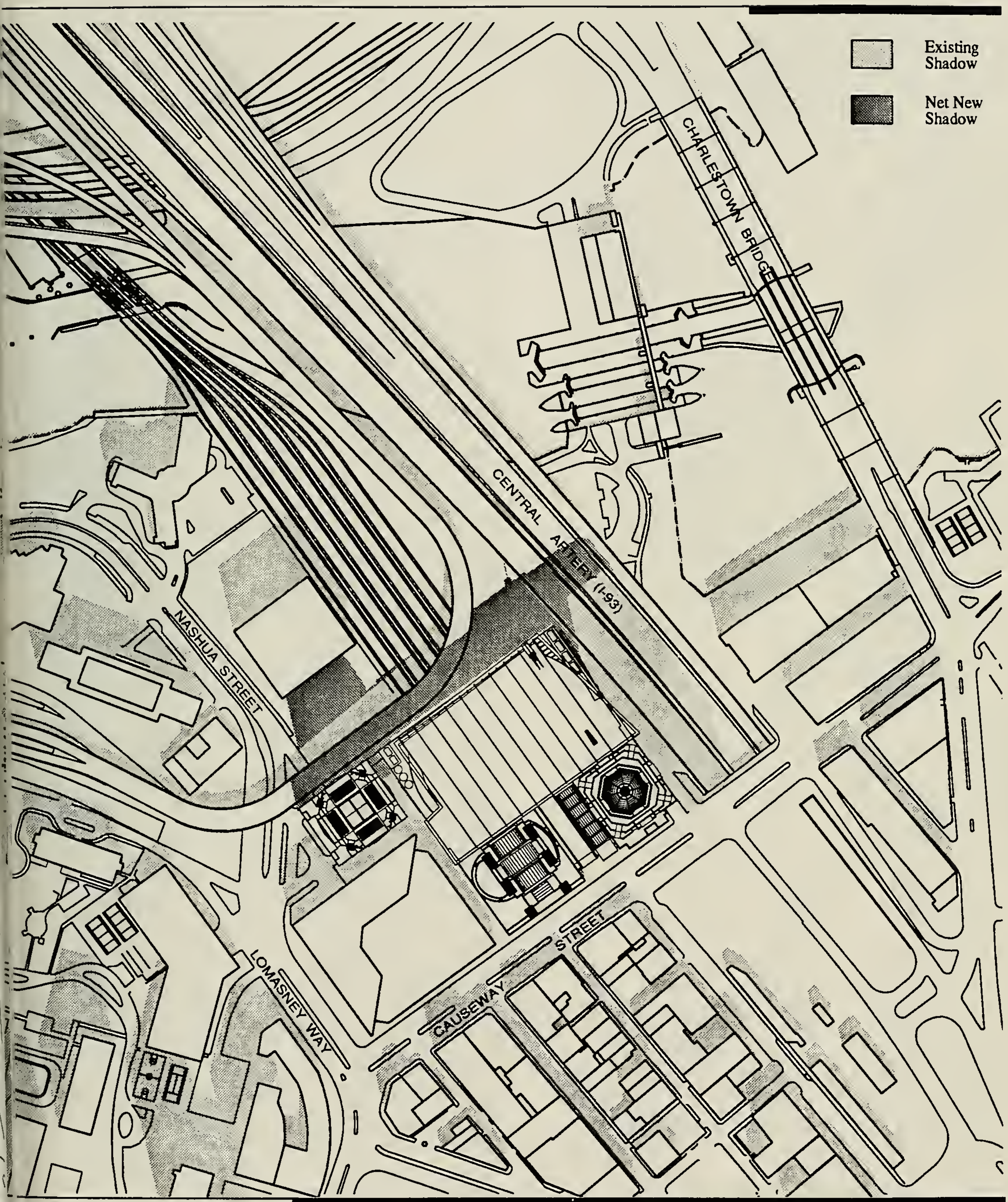
Figure IV-H-9



Vanasse Hangen Brustlin, Inc.

Shadow Condition
September 21; 9:00 AM

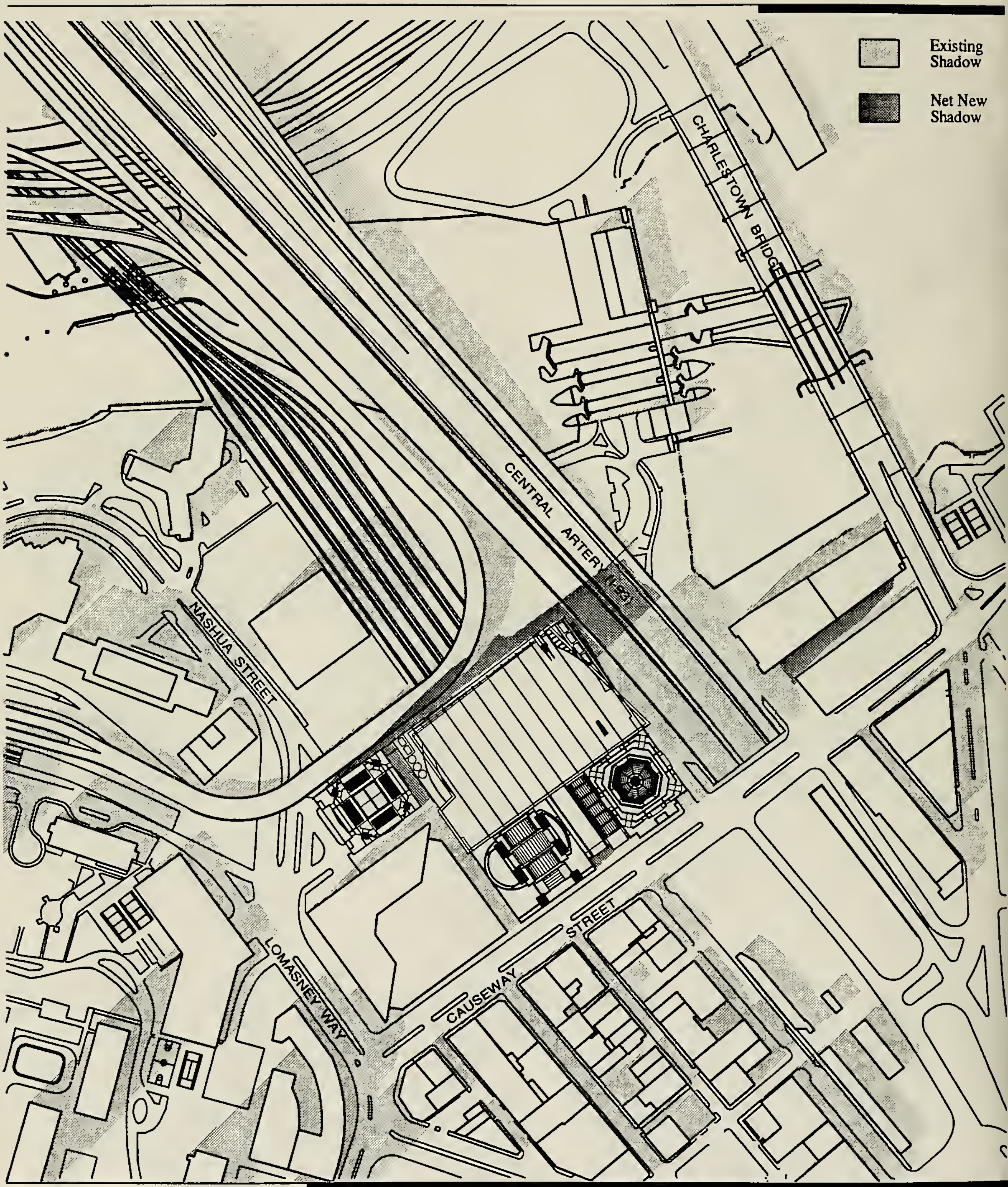
Figure IV–H–10



Vanasse Hangen Brustlin, Inc.

Shadow Condition
September 21; 12:00 Noon

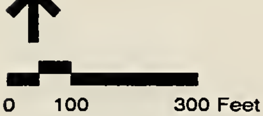
Figure IV-H-11

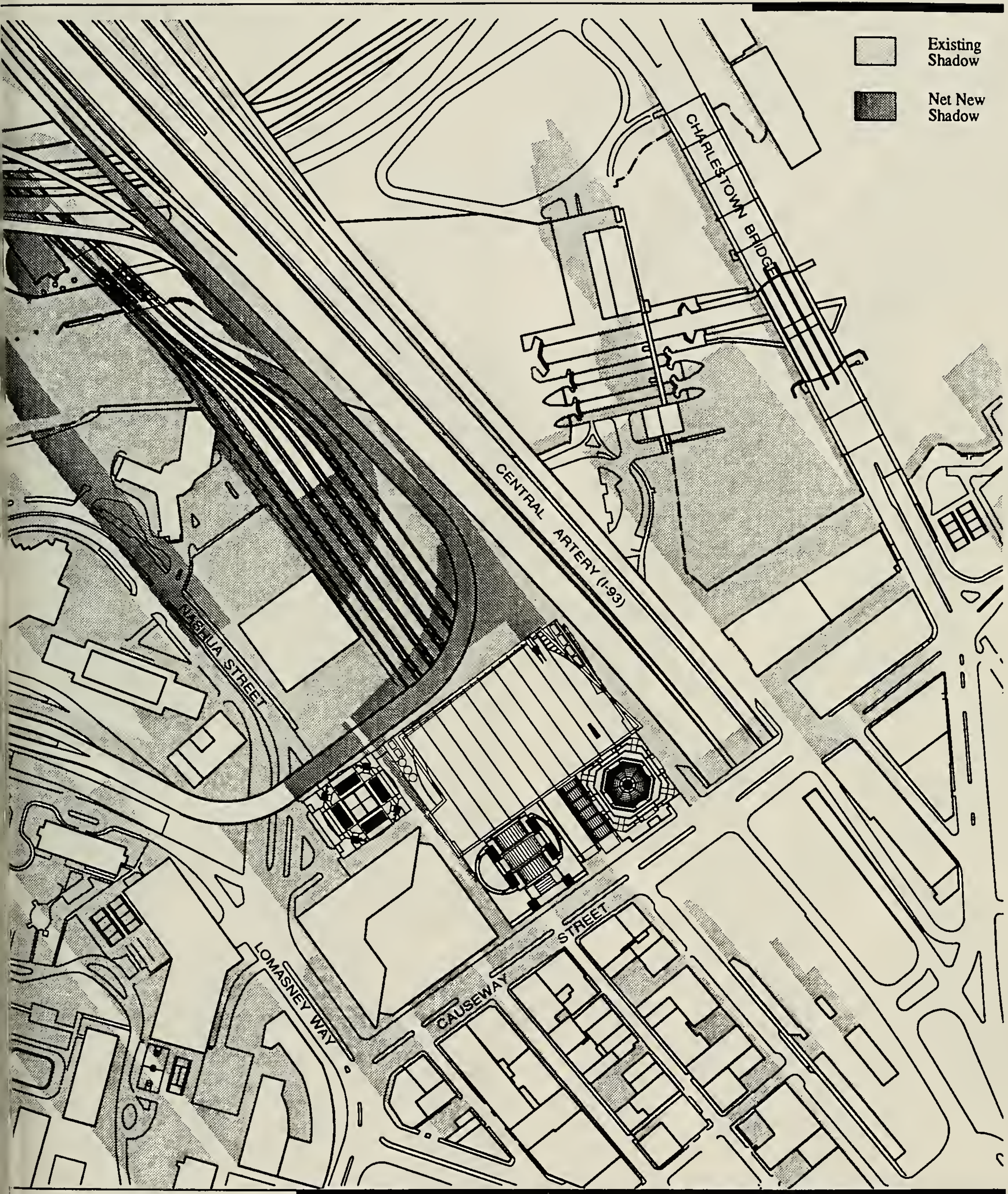


Vanasse Hangen Brustlin, Inc.

Shadow Condition
September 21; 3:00 PM

Figure IV-H-12

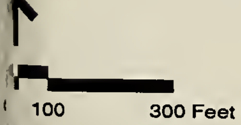


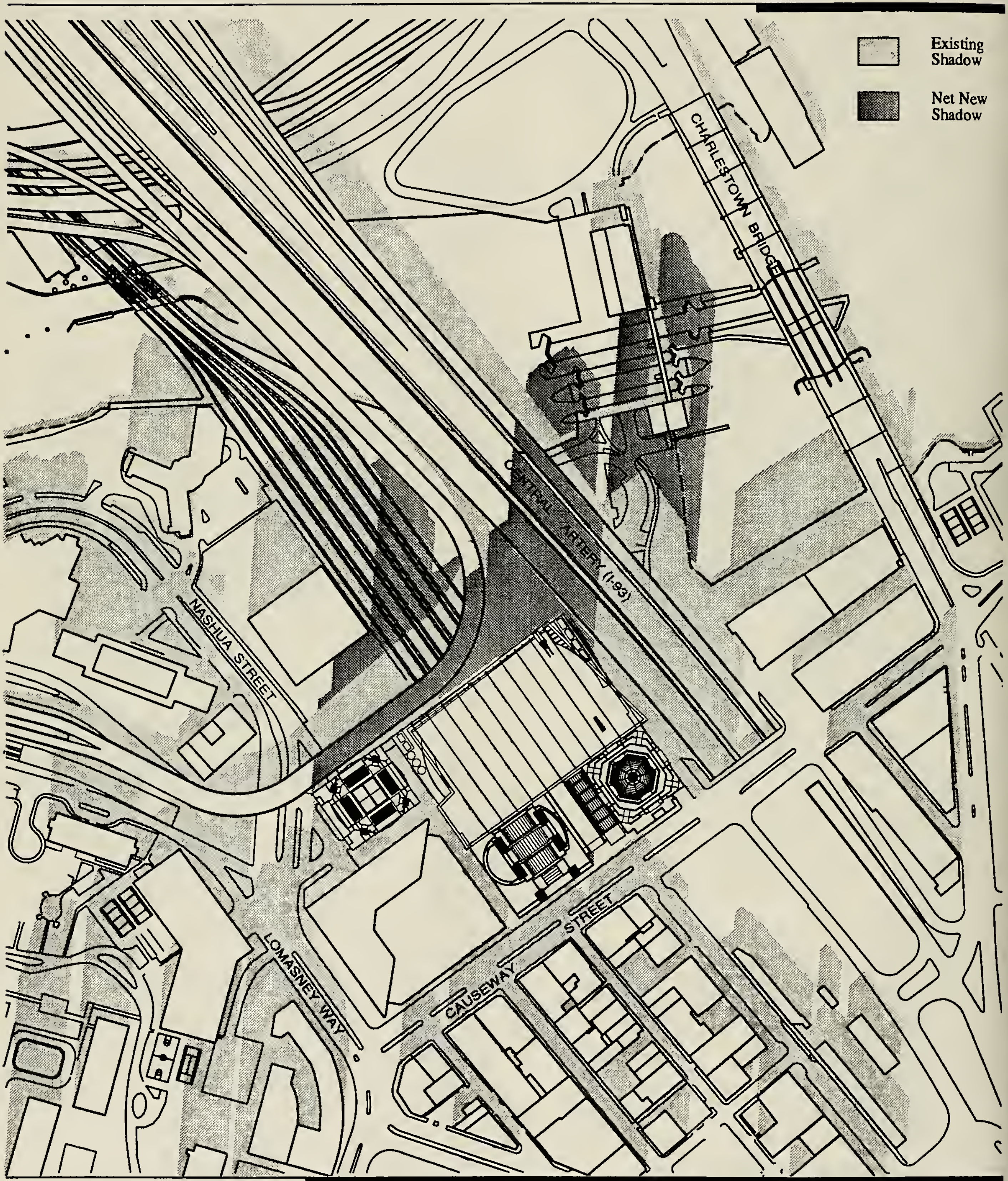


Vanasse Hangen Brustlin, Inc.

Shadow Condition
December 21; 9:00 AM

Figure IV-H-13

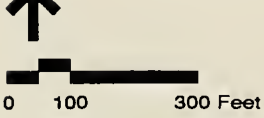




Vanasse Hangen Brustlin, Inc.

Shadow Condition
December 21; 12:00 Noon

Figure IV-H-14



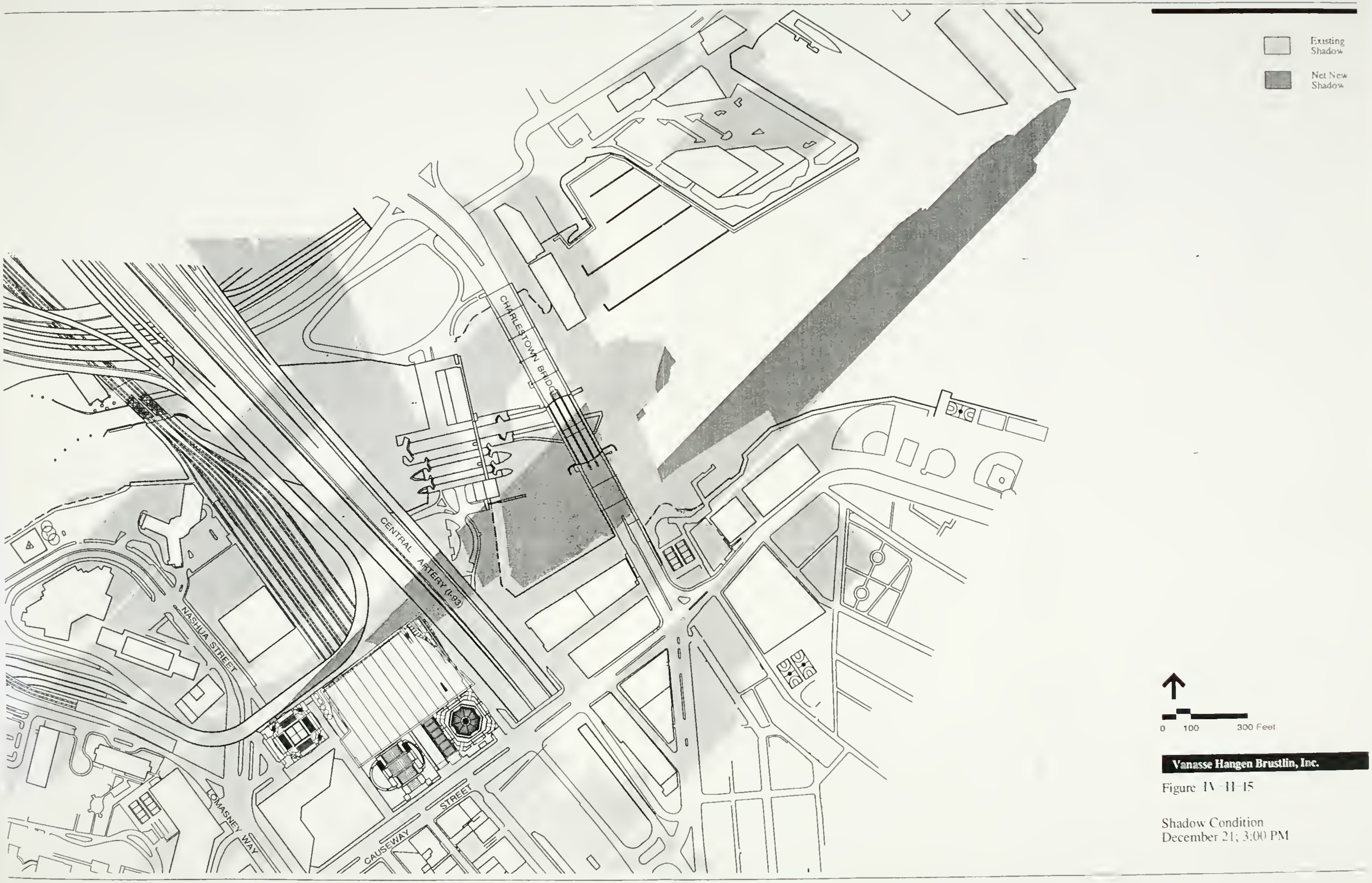


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Figure IV-H-15

Shadow Condition
December 21; 3:00 PM

I Daylighting

INTRODUCTION

The daylighting analysis compared Existing and 2000 Full-Build conditions at pedestrian-level observation points on Causeway Street. For each condition, the percentage of the skyplane obstructed by existing or proposed structures was calculated using the Boston Redevelopment Authority Daylighting Analysis (BRADA) program.[1] As specified in the BRA scoping determination for the New Boston Garden Development (NBGD), the elevated Green Line tracks were excluded from analysis of both Existing conditions and 2000 Full-Build conditions.

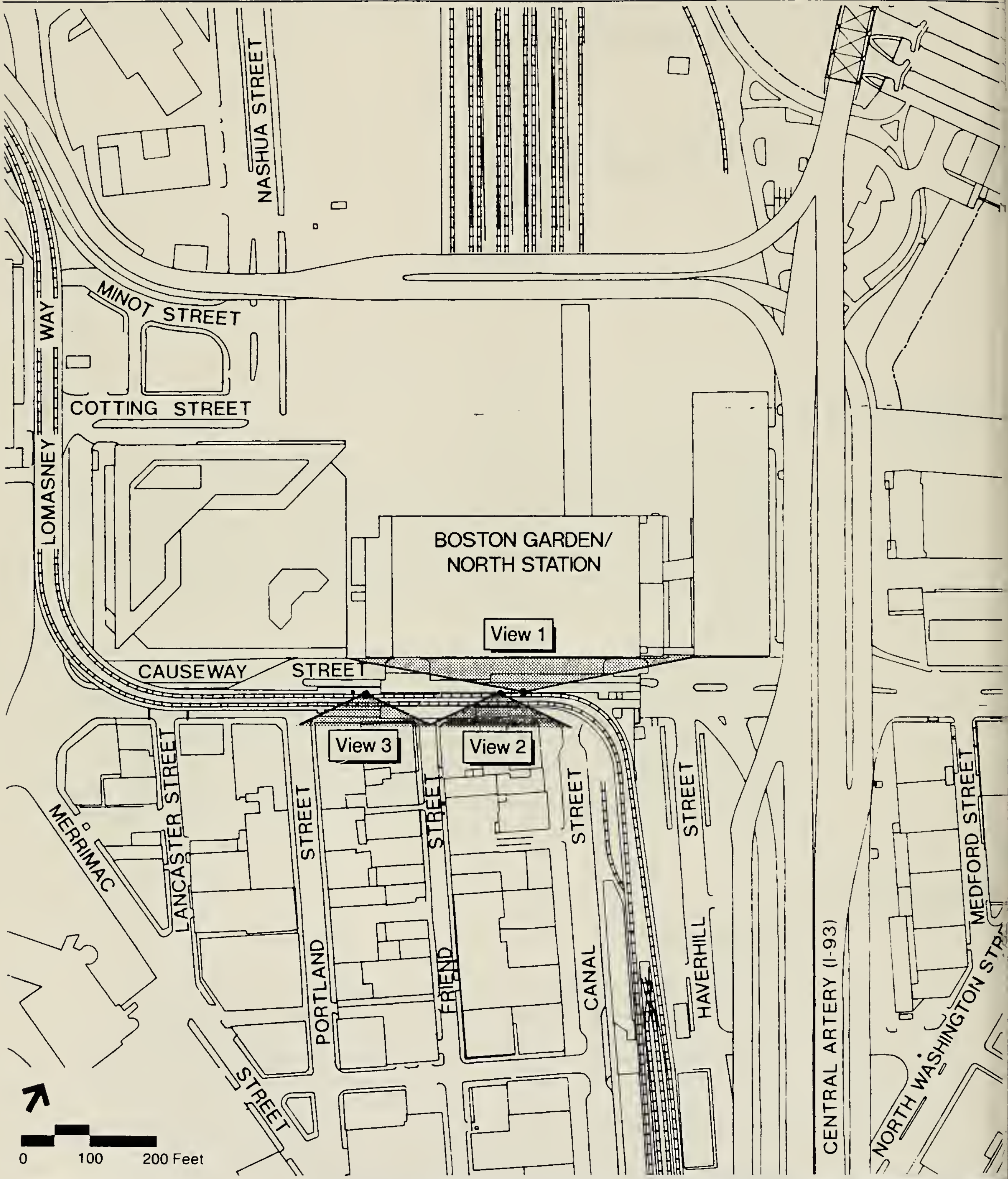
The results of the daylighting analysis for the NBGD indicate that in comparison to Existing conditions, there will be only a slight increase (2 percent) in daylight obstruction on Causeway Street under Full-Build conditions. From a viewpoint on Nashua Street, the skyplane containing the site of proposed Building A undergoes a 55.3 percent increase in daylight obstruction; this portion of the site is vacant at present. The proposed new arena will be set back from Causeway and Nashua streets, thus its impact on daylighting will be minimal.

METHODOLOGY

BRADA Model

The daylight study for the NBGD was performed using the BRADA computer software. The BRADA program calculates the percentage of the skyplane obstructed by a structure or combination of structures. This "skyplane" analysis simulates a person's view of the sky, including peripheral vision, from a specific viewpoint. The model uses the amount of the skyplane (either blocked or open) as an approximation of the amount of daylighting. In a typical analysis, the boundaries of the skyplane are determined by the width of the site and the distance from the site's midpoint to the centerline of the nearest adjacent public way. The model is not highly sensitive, but calculates the amount of skyplane blocked as a function of the structure's base, height, and setbacks at various levels. Based on these parameters, the approximate percentage of daylight blocked from view by the structure is calculated.

1/ Boston Redevelopment Authority Daylighting Analysis (BRADA); Harvey Brian and Susan Stuebing; MIT, Cambridge, MA (1985).



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Daylighting Analysis
View Points
Existing Conditions

Figure IV-1-1

The BRADA model also takes into account the reflectivity of the building materials used on the facade. Stored values for typical building materials are calculated into a numerical factor which reduces the structure's total daylight obstruction percentage. Since many of the proposed project's building materials are as yet unspecified, only unadjusted percentages are presented in this analysis.

BRADA has limitations on input which bear on the analysis of this project. For example, the proposed arcade on Causeway Street can only be analyzed in terms of the impact of its height and width at the facade of the building. In addition, the model cannot analyze complex buildings or streetscapes in one step. Rather, each building or group of buildings has to be analyzed separately. To derive a value for the cumulative daylight obstruction for a complicated view, the daylight obstruction values for separate buildings have to be added together.

Viewpoints

The viewpoints for this analysis were selected in consultation with Boston Redevelopment Authority (BRA) staff and provide a valid comparison of Existing daylighting conditions along Causeway Street with the probable future conditions associated with the proposed project. In order to get a better sense of the daylighting surrounding the project site's Causeway Street facade, analyses of two blocks of buildings in the Bulfinch Triangle area directly opposite Boston Garden/North Station were also performed.

In order to directly compare the 2000 Full-Build conditions with the Existing conditions, the silhouettes of Building B, the Public Concourse, the New Boston Garden, and Building C were analyzed as one facade on Causeway Street. In addition, the impact on daylighting of each individual building as viewed from Causeway Street was also calculated. Since the proposed Building A does not abut Causeway Street at all, a separate analysis for this building was conducted using a viewpoint on Nashua Street. The outlines and setbacks of the New Boston Garden were included in the calculations for each viewpoint from which it was visible.

In the daylighting analysis of Existing conditions, View 1 is located opposite the center of the existing Boston Garden and on the centerline of Causeway Street. As shown in Figure IV-I-1, the width of view extends from the east wall of the General Services Administration (GSA) Building to the eastern edge of Accolon Way, including the entire facade of the existing Boston Garden.

In discussion with the BRA[2], it was determined that consideration should be given to the skyplane obstruction values on both sides of Causeway Street. View 2 is on the centerline of Causeway Street facing the Bulfinch Triangle area, and includes one block of buildings on Causeway Street directly opposite the existing Boston Garden. The width of View 2 extends from the centerline of Canal Street to the centerline of Friend Street. View 3 is located further down the centerline of Causeway Street, and faces another block of buildings on Causeway Street directly opposite the existing Boston Garden, from the centerline of Friend Street to the centerline of Portland Street. The views analyzed along Causeway Street are also shown in Figure IV-I-1.

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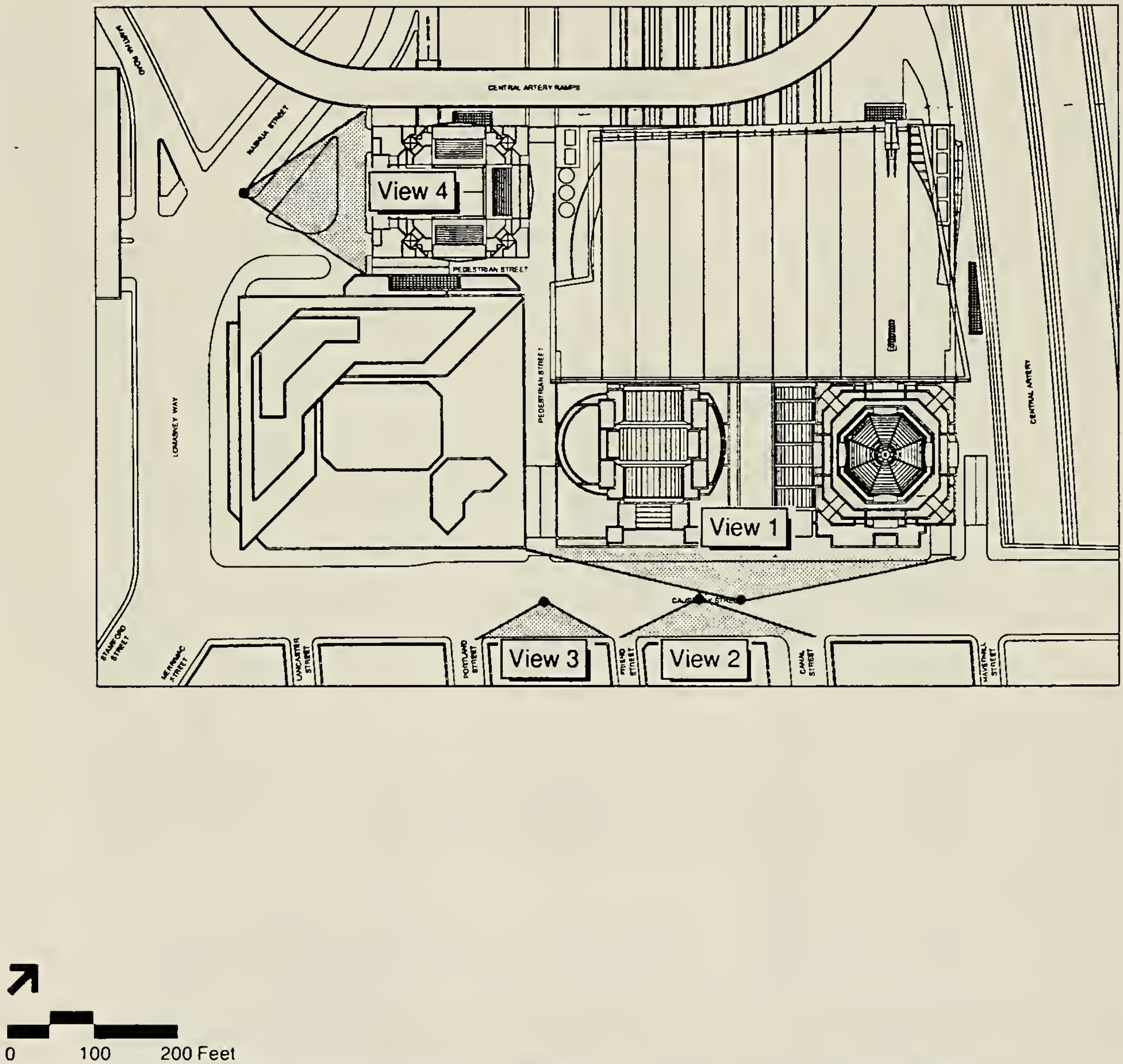
[2] Communications with Eric Schmidt and David Carlson, BRA, 8/22/90.



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Daylighting Analysis View Points
2000 Full-Build Conditions

Figure IV-I-2

For the analysis of 2000 Full-Build conditions, Views 1, 2, and 3 were the same as those used to analyze Existing conditions. Building A was analyzed from View 4, a viewpoint on the centerline of the reconfigured Nashua Street, the nearest adjacent public way, at the midpoint of the base of the structure, using a width of view extending from the northern wall of Building A to the northern wall of the GSA Building. Figure IV-I-2 shows viewpoints analyzed for the Full-Build condition.

As requested by the BRA, separate daylighting analyses of 2000 Full-Build conditions were also performed for each major building component in the proposed Causeway Street grouping--Building B, the Public Concourse, and Building C. The viewpoints for each of these analyses were chosen at the intersection of the midpoint of the base of each structure with the centerline of Causeway Street. Figure IV-I-3 shows the viewpoints selected to calculate individual daylight obstruction percentages for Building B, the Public Concourse, and Building C.

EXISTING CONDITIONS

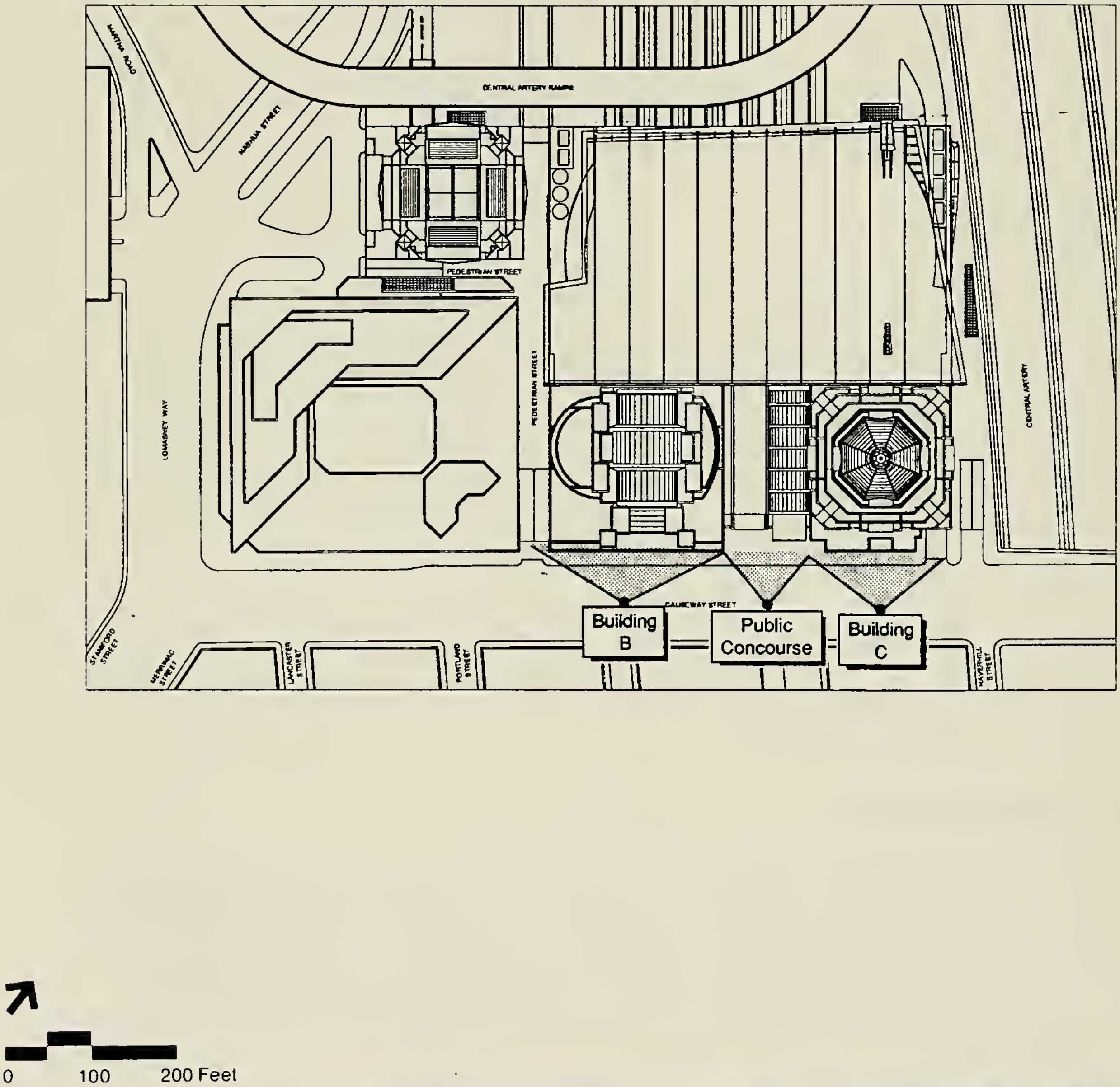
Under Existing conditions, analysis results for View 1 (facade of Causeway Street) indicate a daylight obstruction percentage of 71.4 percent, which is well below the 85 percent daylight obstruction typically observed in downtown Boston.[3] Views 2 and 3 model daylighting on the southern side of Causeway Street. View 2 results in a value of 48.7 percent, and View 3 results in a value of 57.5 percent. Averaging Views 1, 2, and 3, the resultant percentage of skyplane blocked on both sides of Causeway Street in the vicinity of the existing Boston Garden is approximately 59 percent. No BRADA analysis of the existing site of proposed Building A was performed since the site is a vacant lot, and thus, its daylight obstruction value is zero.

Figures IV-I-4, IV-I-5, and IV-I-6 show the results of the BRADA analysis for Existing conditions. The diagrams show the outlines of the building under consideration which approximates the view of an observer looking at the center of the building. The curved skyplane imitates human peripheral vision on a plane of 180 degrees.

PROBABLE PROJECT IMPACTS

A comparative analysis of Full-Build conditions was conducted using the same four viewpoints. Table IV-I-1 presents the daylight obstruction percentages of the Existing and Full-Build conditions for each view. It must be noted that the daylighting analysis conducted for 2000 Full-Build conditions are based on conceptual plans for the commercial component. The proposed buildings fit within the building program and zoning prescribed in the BRA scope of July 18, 1990.

3/ See Commonwealth Center DPIR/DEIR, Volume 1, page 207.



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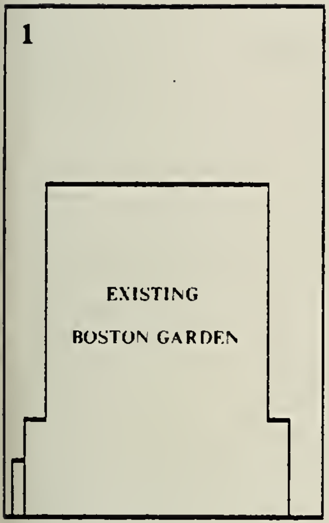
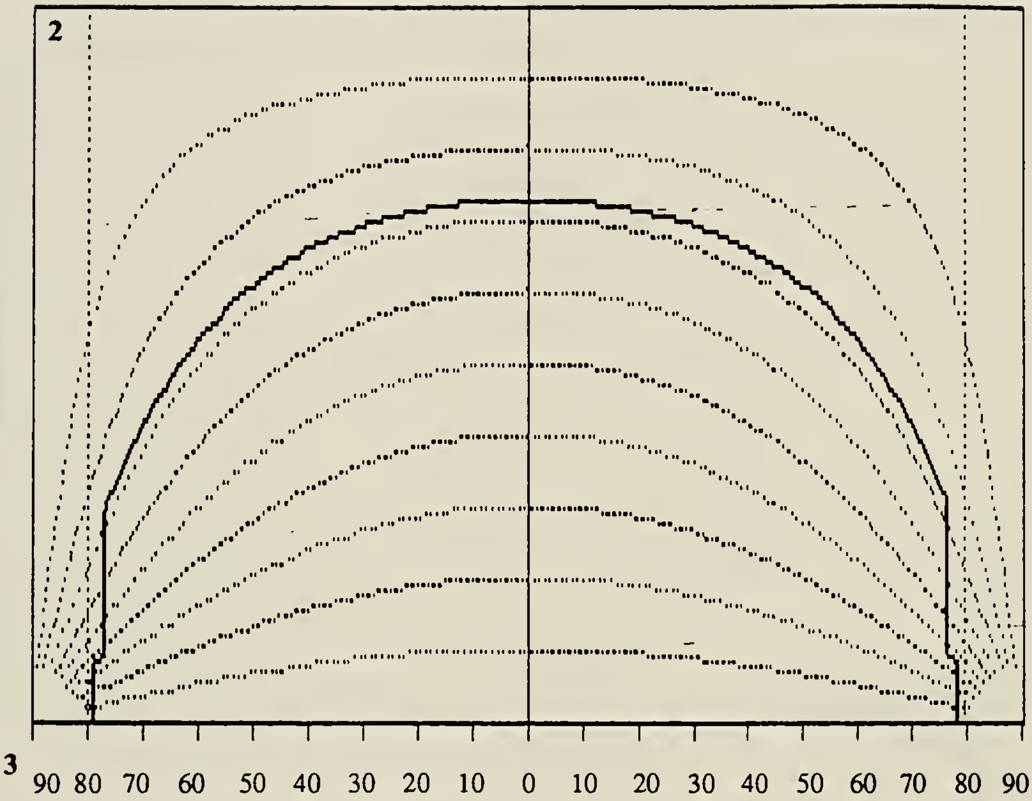
Daylighting Analysis View Points
2000 Full-Build Conditions
Major Building Components

Figure IV-1-3



Boston
Redevelopment
Authority
Daylighting
Analysis



1 Simplified block-massing diagram of building showing view.
2 "Skyplane" diagram representing a view of the building. View is taken from the center of the building. The edges of the building curve downward, just as they would be perceived by the viewer's peripheral vision.
3 180° plane of vision - 90° in each direction.

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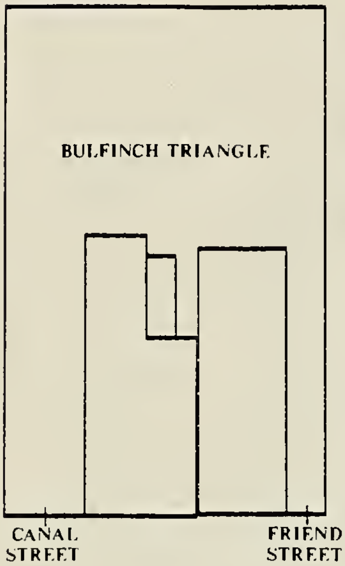
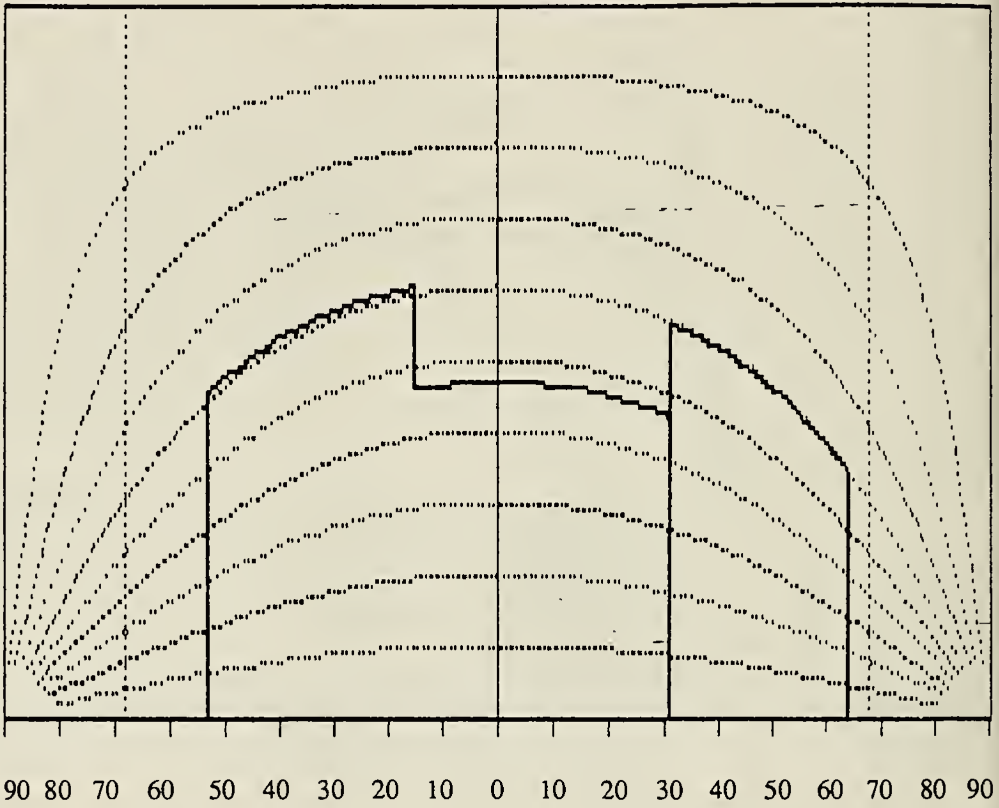
Existing Conditions
View 1

Figure IV-I-4



Boston
Redevelopment
Authority
Daylighting
Analysis



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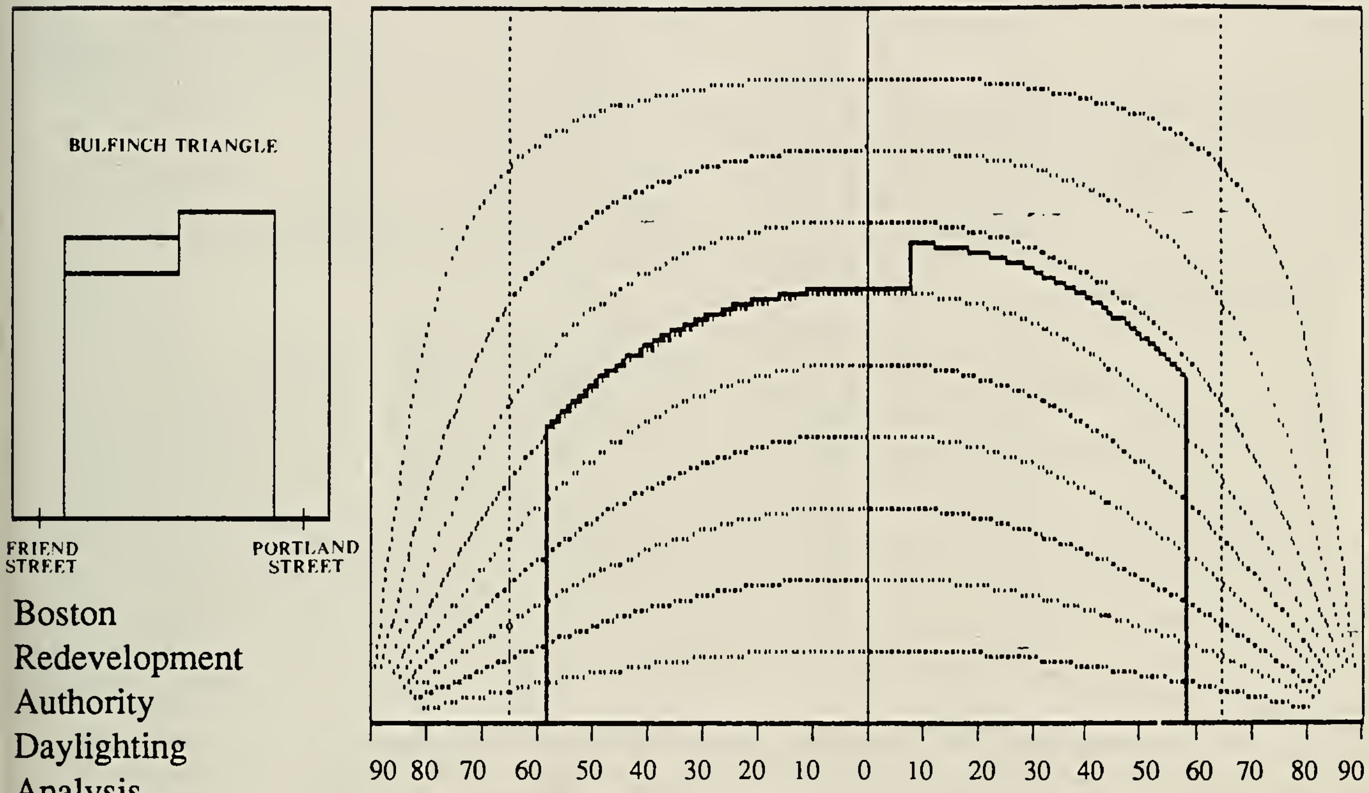
Existing Conditions
View 2

Figure IV-1-5



Boston
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Existing Conditions
View 3

Figure IV-I-6

Table IV-I-1

DAYLIGHT OBSTRUCTION PERCENTAGES*

Viewpoints	Existing (1990) Conditions	Full-Build (2000) Conditions
View 1	71.4%	73.4%
View 2	48.7%	48.7%
View 3	57.5%	57.5%
View 4	0.0%	55.3%

* All values are unadjusted daylight obstruction percentages which do not factor in the reflectivity of the structures' facade materials.

In the case of View 1, which includes Buildings B and C, the arena, and the Public Concourse, the analysis shows a very small increase of only 2 percent in daylight obstruction under the impact of Full-Build conditions. No change is assumed to occur for Views 2 and 3 of existing buildings in the Bulfinch Triangle Historic District area. The impact of proposed Building A and the arena is a 55.3 percent increase in daylight obstruction from the Existing conditions. Since this site is also near view of the Bulfinch Triangle Historic District, it is useful to note that these results compare favorably with the daylight obstruction values of the Bulfinch Triangle studied in View 2 (48.7 percent) and View 3 (57.5 percent). Figures IV-I-5 and IV-I-6, and Figures IV-I-7 and IV-I-8 show the results of the BRADA model for the conditions described above.

The separate daylighting analyses performed on each individual building of the project on Causeway Street grouping exaggerates the individual effects of each structure, due to the narrower widths of view employed. The average of these values, however, closely corresponds to that of Full-Build conditions View 1. Table IV-I-2 shows the daylight obstruction percentages calculated through these separate analyses. Figures IV-I-9, IV-I-10, and IV-I-11 show the results of the BRADA analyses of the three separate structures on Causeway Street.

Table IV-I-2

DAYLIGHT OBSTRUCTION PERCENTAGES

	2000 Full-Build Conditions
Building B	77.1%
Public Concourse and Arena	58.9%
Building C	88.3%
Average Daylight Obstruction Percentage	74.8%

The results of analyzing Building B and the Public Concourse and arena show percentages less than the average daylight obstruction values for downtown Boston, which are typically around 85 percent. In the case of Building C, this average is exceeded by only 3.3 percent. Although included in the analysis of the Public Concourse, the New Boston Garden is set back sufficiently far from the viewpoint so that it is only a minimal factor in the daylighting calculation.

MITIGATION MEASURES

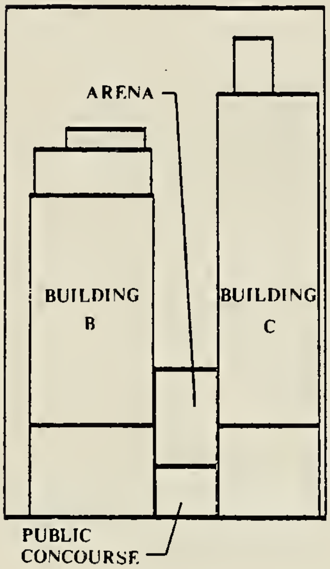
The design of each building component of the New Boston Garden Development considered daylighting issues of the site and vicinity. The resulting daylight obstruction percentage of the existing site abutting Causeway Street is only 2 percent higher than that of the existing Boston Garden. This is due to the following mitigation measures:

- Setting back the tower elements of Buildings B and C from the front of their base structures (55 feet for Building B, and 23 feet for Building C)
- Designing the height of the Public Concourse to be 55 feet
- Setting the arena 191 feet back from the Causeway Street facade of the development

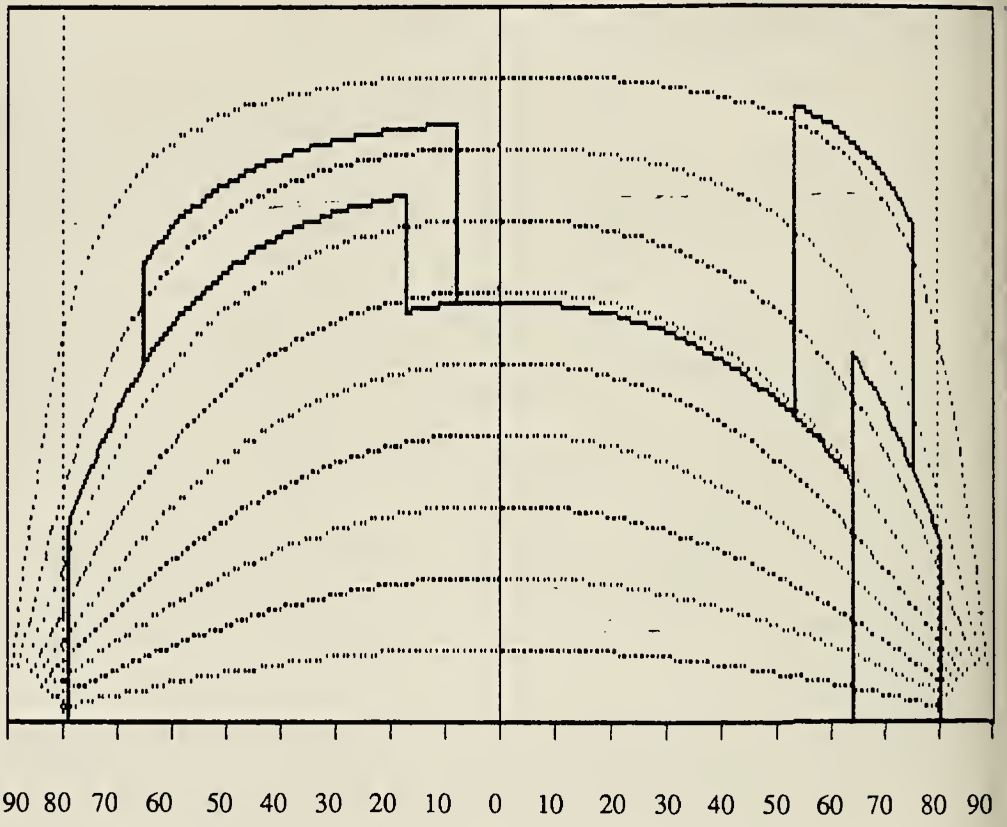
In the case of Building A, building setbacks mitigate impacts to daylighting as much as possible.

CONCLUSIONS

The New Boston Garden Development will not significantly impact the daylighting surrounding the portion of the site fronting Causeway Street. Building A will not impact daylighting on Causeway Street. As viewed from Nashua Street, the impact of Building A and the New Boston Garden on daylighting will not exceed the average daylight obstruction percentage of at least two blocks of the nearby Bulfinch Triangle Historic District. These results indicate that, from all viewpoints, the proposed project will result in a level of daylight obstruction comparable to or less than the average of most buildings in downtown Boston and compatible with adjacent historic neighborhoods.



Boston
Redevelopment
Authority
Daylighting
Analysis



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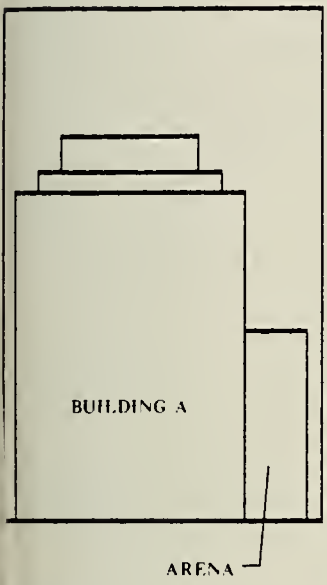
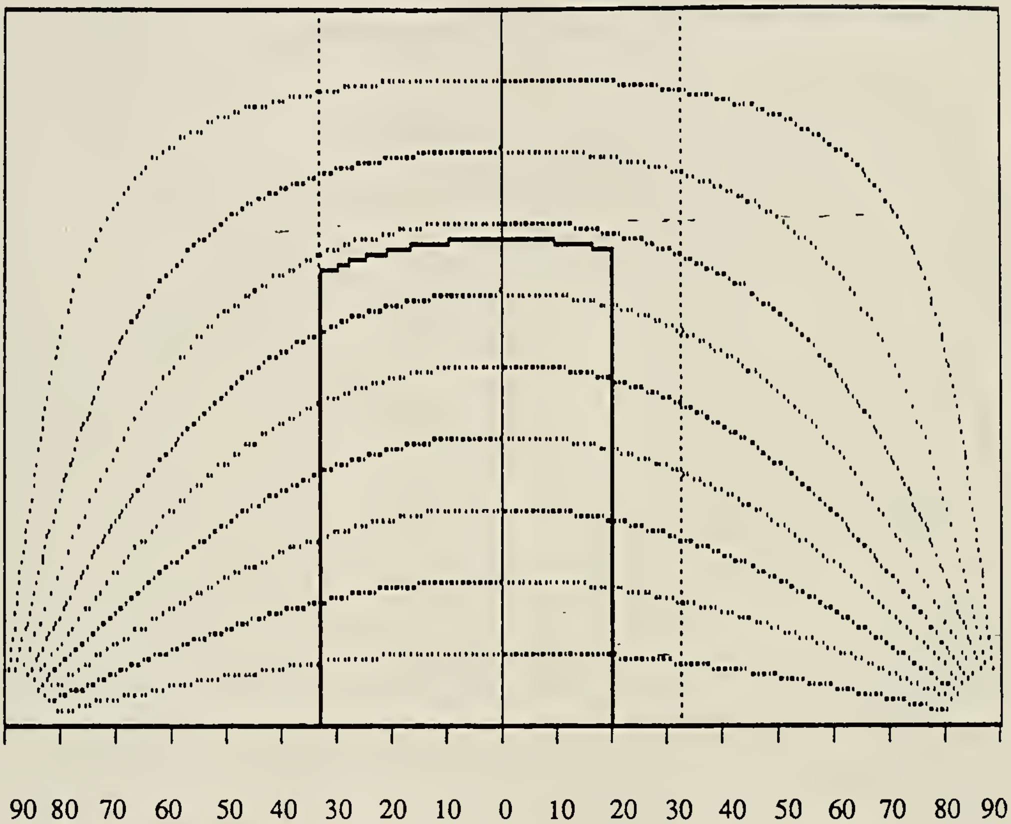
2000 Full-Build
View 1

Figure IV-I-7



Boston
Redevelopment
Authority
Daylighting
Analysis



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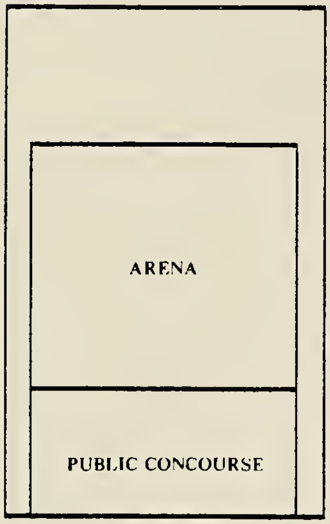
2000 Full-Build
View 4

Figure IV-1-8



Boston
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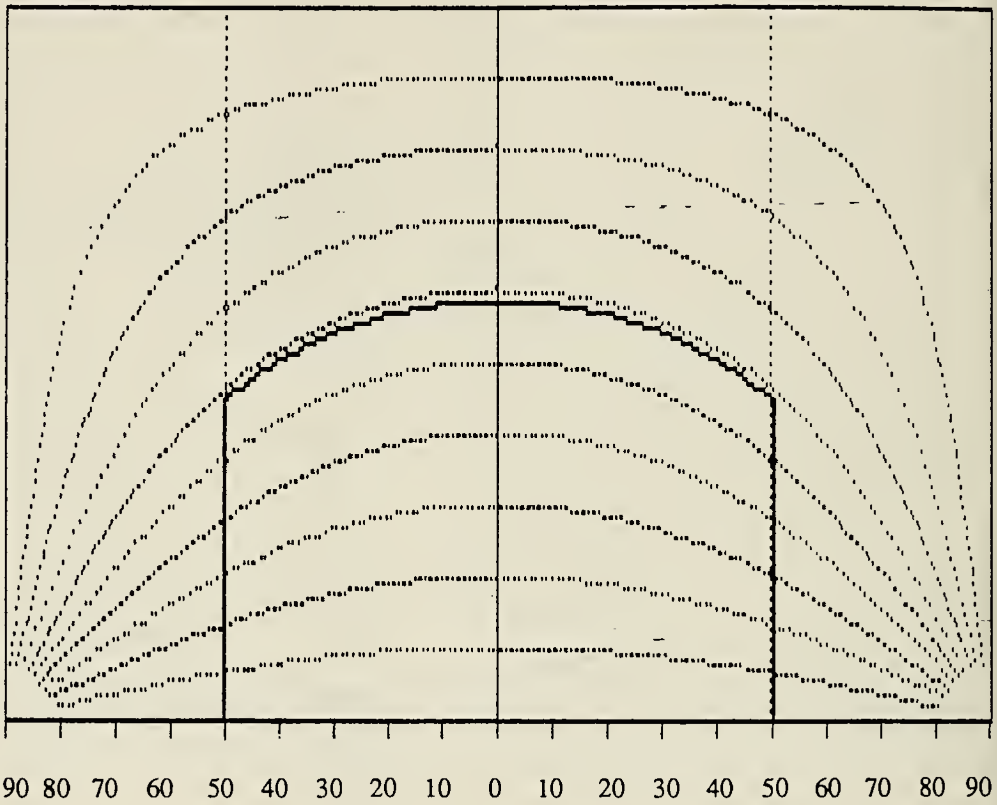
Authority
Daylighting
Analysis



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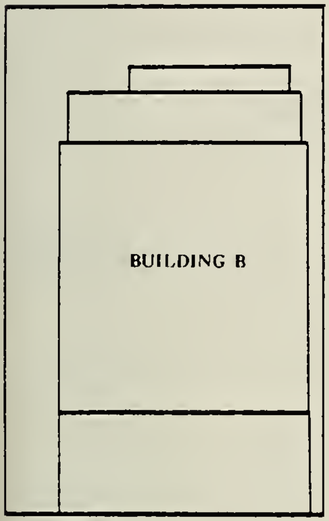
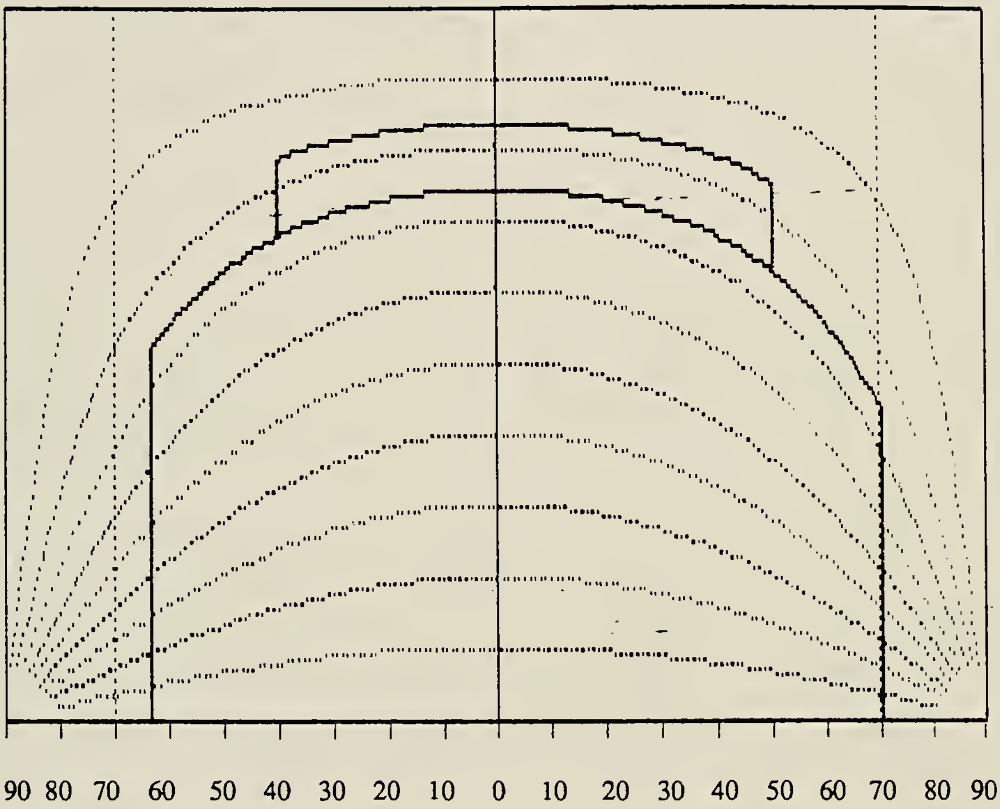
2000 Full-Build
Public Concourse and Arena

Figure IV-I-9



Boston
Redevelopment
Authority
Daylighting
Analysis



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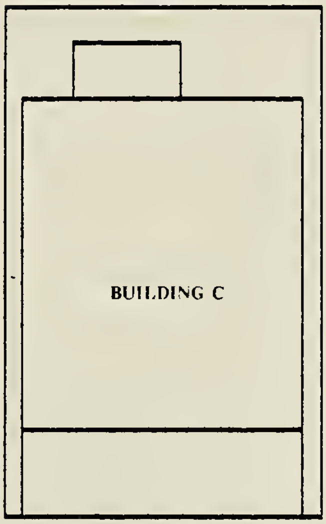
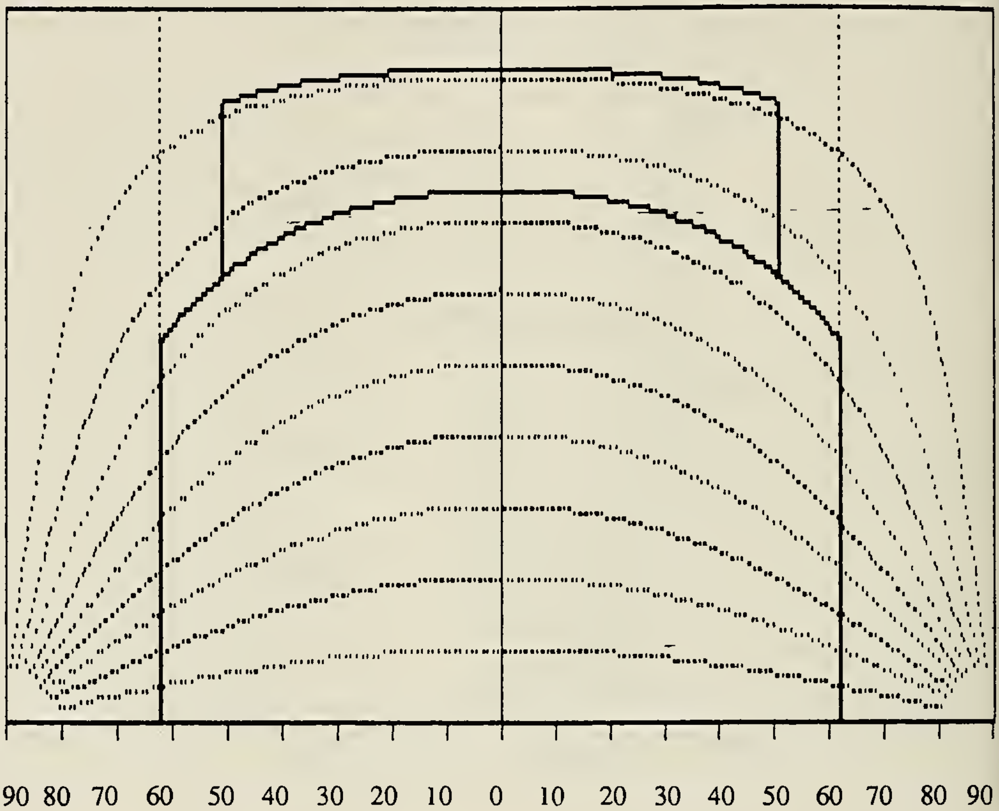
2000 Full-Build
Building B

Figure IV-I-10



Boston
Redevelopment
Authority
Daylighting
Analysis



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2000 Full-Build
Building C

Figure IV-1-11

J Infrastructure

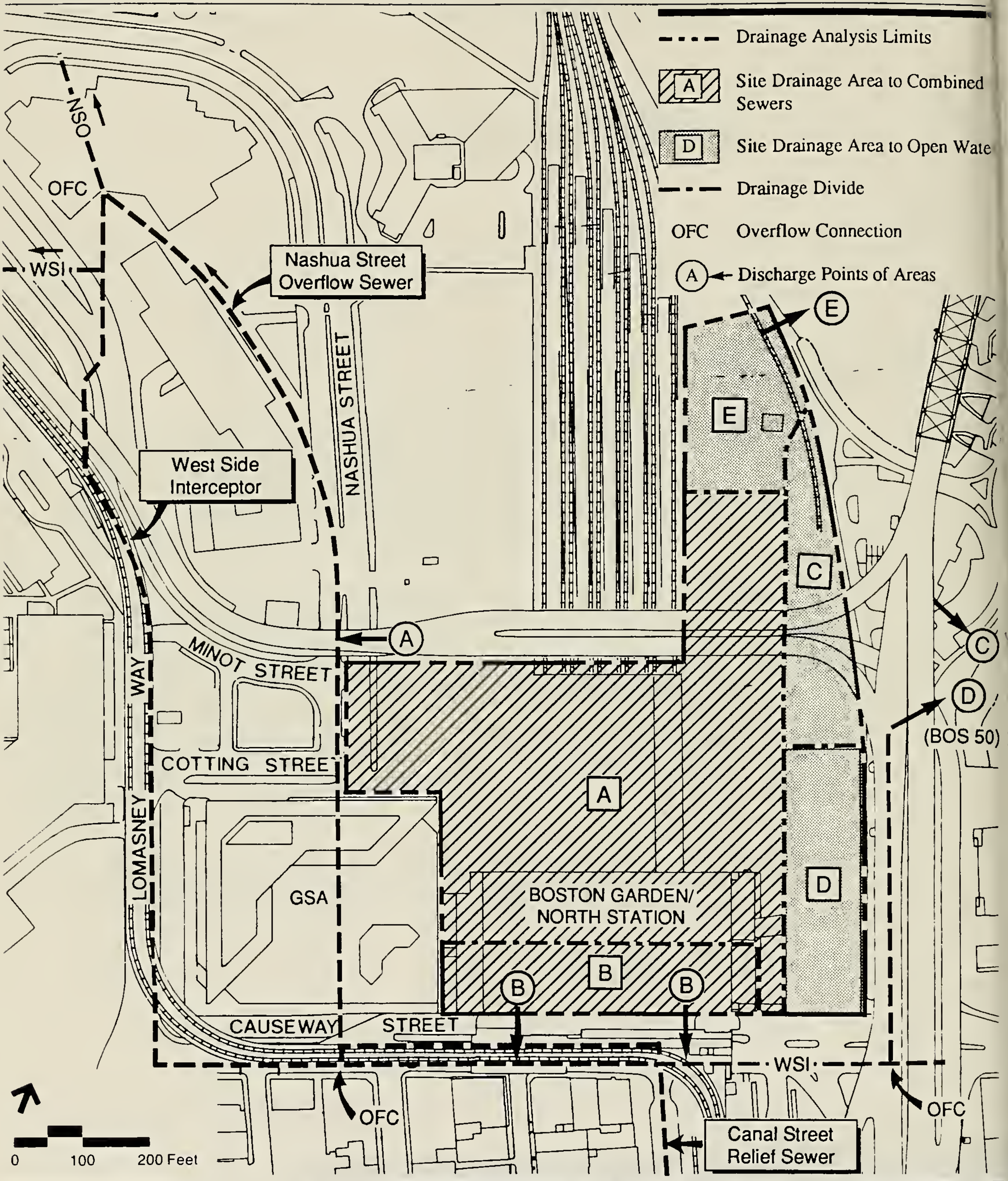
INTRODUCTION

The purpose of this section is to evaluate the effects of the New Boston Garden Development on the storm drainage, sanitary sewer, water supply, and energy systems in the project area. The section provides a description of how these systems currently operate, an analysis of how the proposed project will affect these systems, and what measures the proponent will incorporate into the project to mitigate environmental effects.

Meetings have been held with the numerous public and private agencies responsible for the area's utility systems. The agencies include the Boston Water and Sewer Commission (BWSC), which is responsible for the City of Boston's water, sewerage, and drainage systems; the Massachusetts Water Resources Authority (MWRA), which is responsible for the supply of water to the region as well as the regional sewerage collection and treatment systems; the Boston Gas Company, suppliers of natural gas; and the Boston Edison Company, distributors of electrical power. These meetings allowed the proponent to fully understand and evaluate each system and to design the project to prevent the disruption to these existing systems.

The results of the analyses indicate that the infrastructure systems exist to serve the project and development of the arena and ultimately the 2000 Full-Build conditions without impact to existing systems. The proposed design of the utility systems will provide positive benefits to the project area, such as:

- Stormwater flow will be removed from the combined sewer system thereby providing additional sewage capacity
- Water quality will be improved by removal of stormwater flow, since combined sewer overflows will be reduced
- Stormwater drainage systems will be designed with features such as hoods, sumps, oil/water separators to remove sediments, oil, and grease from the discharge
- Stormwater systems will be maintained and cleaned by the proponent



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Existing
Site Drainage Areas

Figure IV-J-1

- Stormwater from the site will be removed from the combined sewer system
- Water-saving features and energy efficient design for the project will reduce demands

STORM DRAINAGE SYSTEM

Existing Conditions

The project site is an urban site, consisting of the existing Boston Garden, 150 Causeway Street (Anelex Building) and associated roadways, sidewalks, and parking lots. The stormwater runoff from these highly impervious surfaces flow to either storm drainage or combined sewer systems.

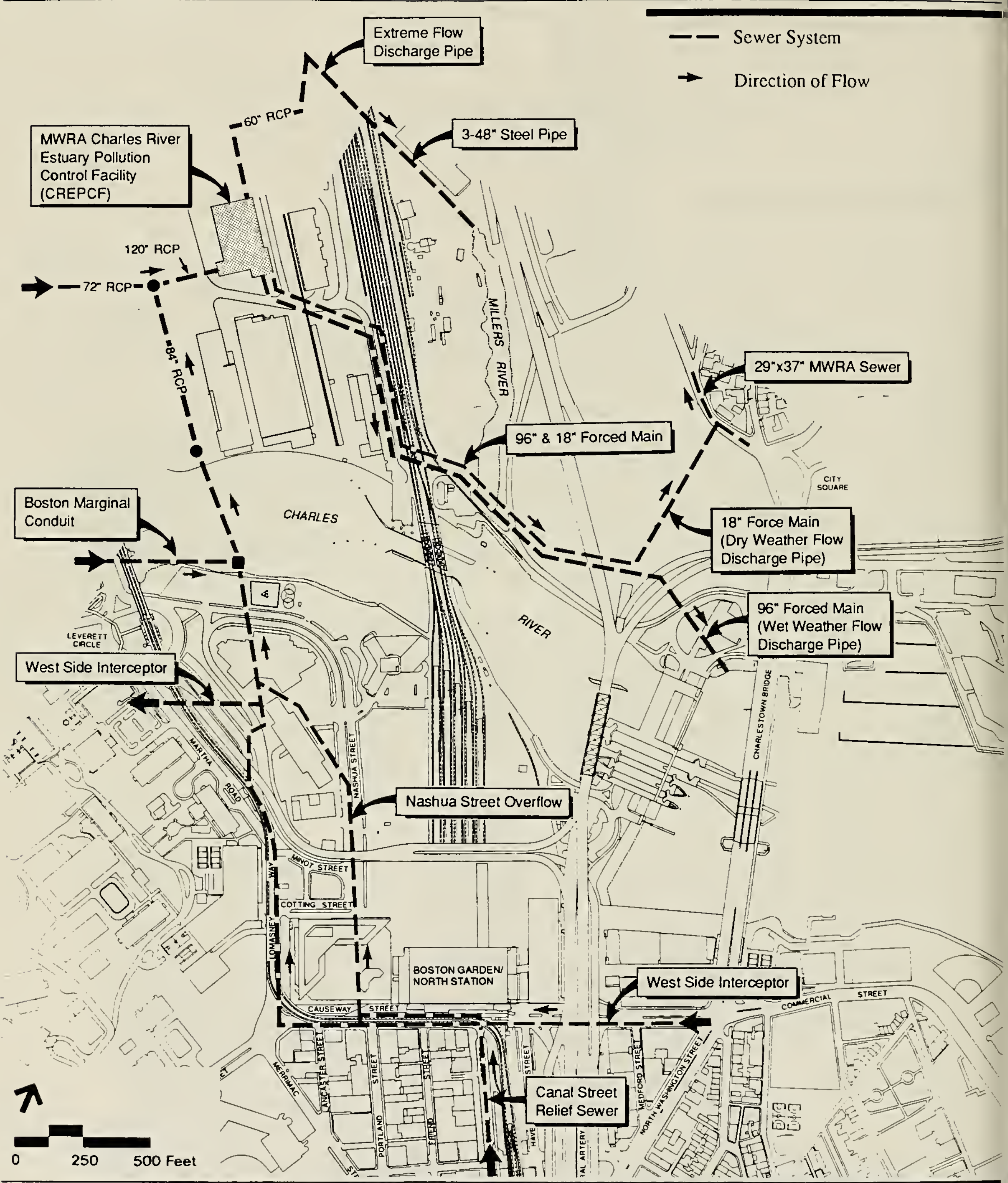
Due to the site topography and size of this urban site, it is divided into five drainage areas that cover 9.89 acres which individually drain to five separate systems--the West Side Interceptor (WSI), the Nashua Street Overflow Sewer (NSO), and three storm drainage lines (see Figure IV-J-1). The WSI and NSO are combined sewers which ultimately convey both sewage and stormwater discharge to the MWRA Deer Island Treatment Plant. Both the WSI and the NSO are part of the BWSC system. The BWSC and MWRA combined sewer systems are discussed in detail later in this section (Sanitary Sewer system).

Two storm drainage lines drain to Boston Harbor and one storm drainage line drains to the Charles River. The systems carry the site stormwater runoff from the point of project discharge to their ultimate outfalls in either Boston Harbor or the Charles River. These storm drainage lines convey only stormwater runoff and, at present, there is no system in place to separate oil, gas, and grease from runoff before discharge into the Boston Harbor or Charles River.

Drainage Areas

Below are descriptions of the five drainage areas and an explanation of the systems to which stormwater runoff from the drainage areas flow. Figure IV-J-1 shows the location of these areas and systems and their relation to the site.

Drainage Area A. Drainage Area A is the largest of the five that cover the site. It includes the northern half of the existing Boston Garden, the Massachusetts Bay Transportation Authority (MBTA) property north of Boston Garden, and a small portion of the existing commuter railroad tracks. The runoff from this area is collected through a 24-inch drain line which runs east to west along the northern edge of the site. This 24-inch drain line eventually connects to the 72-inch by 90-inch Nashua Street Overflow Sewer (NSO) in Nashua Street. The NSO, which is owned and maintained by the BWSC, continues on Nashua Street to the Charles River where it connects into the MWRA collection system. The MWRA collection system continues to the MWRA Charles River Estuary Pollution Control Facility (CREPCF). Dry weather flow to the CREPCF is pumped to the MWRA collection system and eventually to the Deer Island Treatment Plan. Wet weather flow is treated at the facility and discharged to the Charles River (see Figure IV-J-2). The NSO and MWRA systems are discussed in detail later in this section (Sanitary Sewer System).



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MWRA CREPCF & Connecting Sewers

Figure IV-J-2

Drainage Area B. Drainage Area B includes the southerly portion of the site that abuts Causeway Street. It consists of the southern half of the existing Boston Garden and the area between the existing Boston Garden and the General Services Administration (GSA) Building. This area drains directly to the West Side Interceptor (WSI) in Causeway Street. The WSI continues through the Back Bay section of Boston where it eventually connects to the MWRA Boston Main Drainage Relief Sewer and then to the Deer Island Treatment Plant (see Figure IV-J-3).

Drainage Area C. This drainage area includes the northeast portion of the site. The on-site portion of the drainage area consists of paved parking lots. Runoff from this drainage area is collected in a series of catchbasins which connect to an 18-inch storm drain line on the adjacent Metropolitan District Commission (MDC) property. The 18-inch storm drain discharges into Boston Harbor north of Beverly Street.

Drainage Area D. This drainage area includes 150 Causeway Street (the Anelex Building) and the parking area north of it. It drains to a 36-inch drainage line in Beverly Street, which discharges to Boston Harbor at a former combined sewer overflow (CSO) known as BOS #50. This CSO previously functioned as an overflow for the WSI during storm events. In 1989, this overflow connection was temporarily discontinued by the BWSC and, since that time, only storm drainage which enters downstream of the overflow connection is discharged at this location.

Drainage Area E. This is the drainage area located to the northeast of the site and includes a portion of the Massachusetts Department of Public Works (MDPW) land to be used for parking. It consists of a paved parking lot and a railroad operations area. Drainage from this area flows to an 18-inch pipe which discharges to the Charles River. Drainage from this area currently discharges directly to the river without any oil, gas, or grease removal.

Drainage Analysis

A drainage analysis of the existing project site and the adjacent land contained within the five drainage areas was performed to determine the quantity of runoff generated from each of the five drainage areas. The analysis was conducted by computing the existing peak discharge rate from each of the five drainage areas utilizing the "rational formula." The rational formula is a widely used empirical method which relates runoff (peak discharge rate) to rainfall. It is the industry standard for the computation of runoff in an urban setting and is primarily used for the design of storm drainage systems. The formula is:

$$Q = cia$$

Where:

Q = Peak discharge rate in cubic feet per second (cfs).

c = Runoff coefficient, which expresses the percent of rainfall that will run off a surface. For example, 0.9 represents the runoff coefficient for pavement, while 0.3 represents the runoff coefficient for grass.

i = Average rainfall intensity in inches per hour. Values of intensity are determined by charts developed by the US Weather Bureau for all areas of the country. The average rainfall intensity (i) is dependent upon the time of concentration to the point under consideration. For urban storm sewers, the time of concentration consists of the time of overland flow to the inlet plus the time of flow in the pipe from the most remote inlet to the point under consideration. As a result, "i" values will vary on any given site. Large "i" values indicate a shorter travel time for stormwater flow for a given storm frequency.

a = Drainage area in measured acres.

The existing peak discharge rate was computed based on a ten-year design storm as requested by BWSC which is a commonly accepted storm event used by BWSC for the design of urban storm drainage systems. A summary of the Existing conditions drainage analysis is shown in Table IV-J-1.

Table IV-J-1 EXISTING CONDITIONS DRAINAGE ANALYSIS

Drainage Area	Receiving System	Drainage Area Breakdown (Acres) Paved	Roof	RR Tracks	Total	Runoff Coefficient	Rainfall Intensity (in/hr)	Peak Discharge Rate (cfs)*
Area A	CS	5.10	1.02	0.19	6.31	0.9	4.0	22.7
Area B	CS	0.06	0.9	-	0.96	0.9	4.1	3.5
Subtotal Draining to Combined Sewer (CS)					**7.27**			**26.2**
Area C	SD	0.84	-	-	0.84	0.9	4.9	3.7
Area D	SD	-	0.94	-	0.94	0.9	3.8	3.2
Area E	SD	0.84	-	-	0.84	0.9	5.5	4.1
Subtotal Draining to Storm Drain (SD)					**2.62**			**11.0**
TOTAL		6.84	2.86	0.19	9.89			37.2

* Cubic feet per second.

The analysis indicates that majority of the site in the five drainage areas (74 percent) drains to the combined sewer systems. The remaining 26 percent of the site (2.62 out of 9.89 acres) flows to the three storm drains. The existing drainage of 74 percent of the site to combined sewer systems has a negative impact on the existing sewerage collection system and during heavy rains, contributes to the discharge of untreated sewage into the Charles River and Boston Harbor.

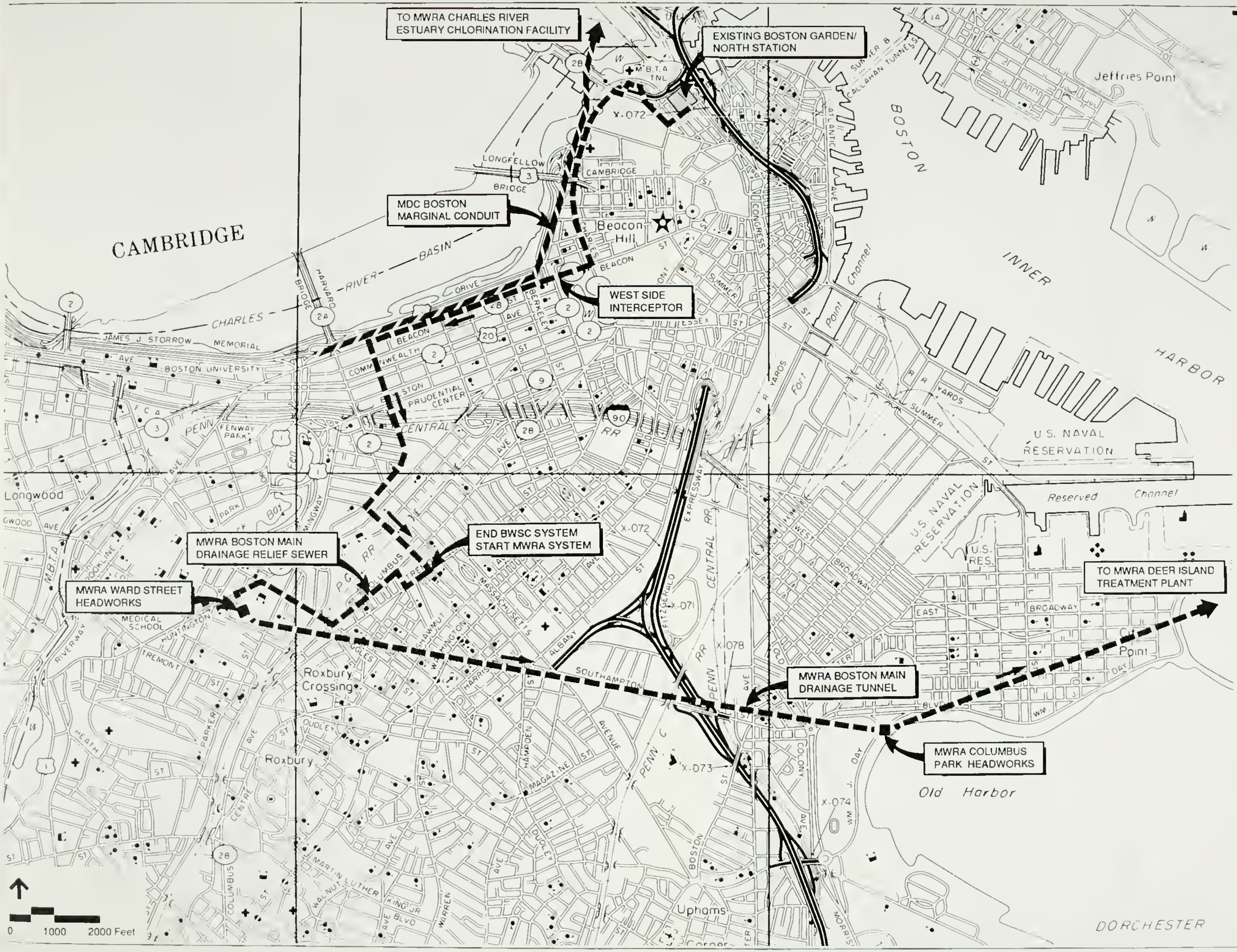
Route of Project Sewage
TO MWRA CHARLES RIVER ESTUARY CHLORINATION FACILITY
EXISTING BOSTON GARDEN/ NORTH STATION
MDC BOSTON MARGINAL CONDUIT
WEST SIDE INTERCEPTOR
MWRA BOSTON MAIN DRAINAGE RELIEF SEWER
END BWSC SYSTEM START MWRA SYSTEM
MWRA WARD STREET HEADWORKS
TO MWRA DEER ISLAND TREATMENT PLANT
MWRA BOSTON MAIN DRAINAGE TUNNEL
MWRA COLUMBUS PARK HEADWORKS
CAMBRIDGE
CHARLES RIVER BASIN
Beacon Hill
Jeffries Point
BOSTON INNER HARBOR
U.S. NAVAL RESERVATION
Reserved Channel
Longwood
Roxbury Crossing
Roxbury
Uphams Corner
Old Harbor
DORCHESTER
Point
X-072
X-071
X-078
X-073
X-074
0 1000 2000 Feet

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Figure IV-J-3

BWSC & MWRA System Project Sewage Route

Probable Project Impacts

At the completion of the project (2000 Full-Build conditions), the site will consist of the New Boston Garden, Buildings A, B, and C, the Public Concourse, the underground project Garage, and associated parking areas, roads, and sidewalks. To establish the future stormwater flows that will be generated by the development, a 2000 Full-Build conditions drainage analysis was performed. As was the case in the Existing conditions analysis, the project site was divided by drainage area. Under the 2000 Full-Build conditions, as in the Existing conditions, there will still be five distinct drainage areas, however, the size of these areas has changed dramatically.

The redefinition of the drainage area is a direct result of meetings held with BWSC to discuss the project. The project proponent was requested by BWSC to construct a new drain line to the Charles River and to divert to it as much of the stormwater runoff entering into the NSO and the WSI as possible. The diversion of stormwater into the project's own drainage system would significantly reduce flows to the NSO and WSI systems, provide separation of sewage flows from stormwater flows, and increase sewage capacity in the existing lines. As part of the drainage design for the project, the project proponent has proposed a new 42-inch drain line. This new drainage line will collect a majority of the stormwater runoff generated from the site (as well as the underdrainage from the project Garage under Buildings B and C) for treatment and discharge to the Charles River.

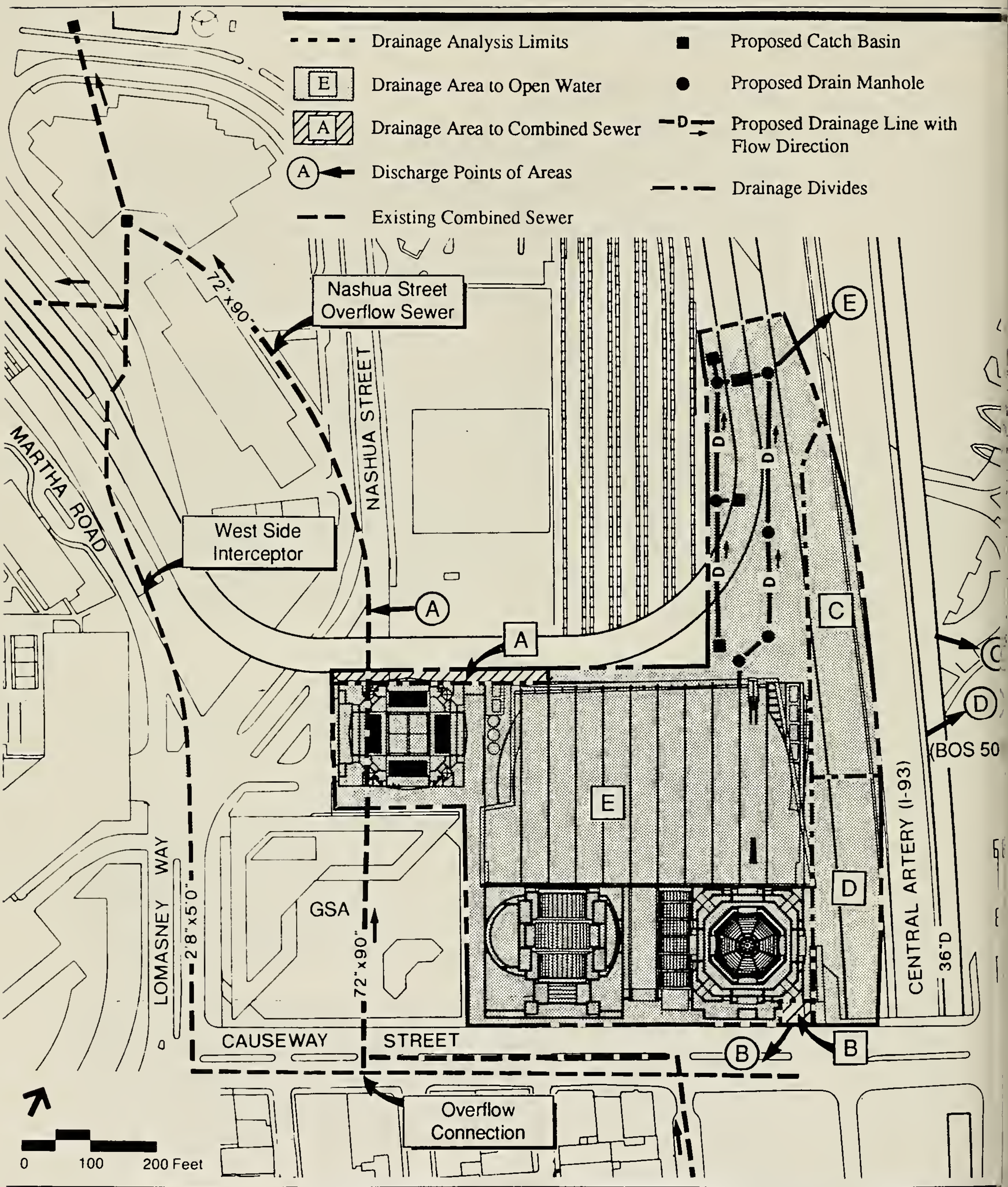
Drainage Areas

Below is a description of the revised drainage areas and the systems to which the areas drain. These drainage areas and their relationship to the site are shown on Figure IV-J-4.

Drainage Area A. The area will consist of a small residual area along the north boundary of the site which will continue to drain to the NSO. Due to the topography of the site, it is infeasible to direct the total runoff from this area to the new 42-inch drain line. However, as a result of the site design, this drainage area will be substantially reduced from 6.31 acres (under Existing conditions) to only 0.14 acres. This reduction of over 6 acres represents a very positive project benefit because of the substantial flow reduction to the NSO.

Drainage Area B. Area B will include a small section of Accolon Way which will continue to drain to the WSI. Directing the runoff from this area to the new drain line has also been determined to be infeasible because of grades. This new drainage area will be reduced from 0.96 acres to only 0.03 acres, representing a 97 percent reduction in the area of the site draining to the WSI. This will increase the sewage capacity in the WSI, and reduce incidences and volume of combined sewer overflows to the Charles River, thereby improving water quality.

Drainage Area C. The separate storm drainage system serving this area will not experience any change between the Existing and future conditions. The drainage area itself will experience a slight reduction in area due to the construction of the New Boston Garden. It will be reduced from 0.84 acres to 0.81 acres. This area has been taken by eminent domain by the MDPW for the reconstruction of the Central Artery.



Future Site Drainage Areas

Figure IV-J-4

Drainage Area D. Drainage Area D will be reduced slightly (from 0.94 to 0.76 acres) in the future as a result of the demolition of 150 Causeway Street, construction of the New Boston Garden, and the construction of a ramp into the MBTA garage. This area has also been taken by eminent domain by the MDPW for the reconstruction of the Central Artery.

Drainage Area E. In 2000 Full-Build conditions, Area E will be the largest drainage area on the site, increasing from 0.84 acres to 8.15 acres. It will include the New Boston Garden, Buildings A, B, and C, the Public Concourse, as well as associated parking areas, sidewalks, and roadways. All these areas will drain to the new 42-inch storm drain line that will discharge to the Charles River at the northeast corner of the site. This will provide a significant reduction in stormwater flows to the existing combined sewer systems, provide a better quality of runoff by the inclusion in the proposed system of oil/water separator, and reduce the incidences of untreated sewer overflows to the Charles River.

To determine the proposed stormwater runoff flows that will be directed to the new 42-inch storm drainage line pipe as well as the reduced flows to the existing systems, a drainage analysis of the 2000 Full-Build conditions of the site was performed. As was the case for the Existing conditions analysis, the project site was divided into separate drainage areas with each area tributary to either a combined sewer or storm drain line (see Figure IV-J-4).

There will be a slight decrease in the future peak discharge when compared to Existing conditions. This positive change will be a direct result of the redesigned drainage pattern. A majority of the site runoff will be discharged sooner because the path the runoff must follow will be shorter. A summary of the 2000 Full-Build conditions drainage analysis is shown in Table IV-J-2.

The drainage analysis shows that less than 2 percent of the project site and adjacent area (0.17 out of 9.89 acres) will drain to combined sewers. Virtually, the entire site (9.72 out of 9.89 acres) will drain to either the new or existing storm drains. Of the 7.27 acres of the project site which drains to combined sewers under Existing conditions, 7.10 acres will be redirected to the new 42-inch storm drain line that will discharge to the Charles River. This removal will have a direct benefit to the combined sewer systems and the treatment facilities downstream of the site.

Table IV-J-3 demonstrates the results of the stormwater calculations for the Existing and 2000 Full-Build conditions for each of the five drainage areas. The table quantifies a reduction of 25.4 cfs (or 16.5 mgd) of stormwater flow to the existing combined sewers--Areas A and B. Area E diverts the stormwater runoff in the proposed development to a separate drainage system described earlier. The comparison of results illustrate a significant project benefit by the elimination of stormwater to the sewer system under the 1990 New Boston Garden, 1995 Interim-Build, and the 2000 Full-Build conditions. Although an increase to the storm drainage system is shown, there is no significant impact to the outlet point, the Charles River, as described above and in Chapter IV-K, Water Quality.

Table IV-J-2 2000 FULL-BUILD CONDITIONS DRAINAGE ANALYSIS

Drainage Area	Receiving System	Drainage Area Breakdown (Acres)				Runoff Coefficient	Rainfall Intensity (in/hr)	Peak Discharge Rate (cfs)
		Paved	Roof	RR Tracks*	Total			
Area A	CS	0.14	-	-	0.14	0.9	5.5	0.7
Area B	CS	0.03	-	-	0.03	0.9	5.5	0.1
Subtotal Draining to Combined Sewer (CS)					**0.17**			**0.8**
Area C	SD	0.81	-	-	0.81	0.9	4.9	3.6
Area D	SD	0.76	-	-	0.76	0.9	4.7	3.2
Area E	SD	1.74	6.41	-	8.15	0.9	3.7	27.1
Subtotal Draining to Storm Drain (SD)					**9.72**			**33.9**
TOTAL		3.48	6.41	-	9.89			34.7

* The existing commuter rail area will be covered by the New Boston Garden.

Mitigation Measures

In meetings with the BWSC, the proponent was requested to redirect the stormwater runoff that currently enters the combined sewer system, to the Charles River. As the commitment to mitigate the project's storm drainage impacts, the proponent has agreed to provide a new 42-inch drain line to the Charles River, redirecting virtually all of the site runoff which currently flows to combined sewers. All roof drains for the New Boston Garden facility, Buildings A, B, and C, the Public Concourse, and storm drainage from the associated roadways, parking areas, and sidewalks will discharge to the new 42-inch line to be built by the proponent.

The total drainage area studied covers 9.89 acres. Approximately 2 acres is owned by New Boston Garden Corporation (NBGC), while the remaining 7.89 acres is currently owned and maintained by either the MBTA or MDPW. The project will provide for the construction and future maintenance of the storm drainage system for the portion of the site owned by NBGC as well as those areas owned by the MBTA and MDPW. This will eliminate significant construction and maintenance costs of the proposed storm drainage systems which would otherwise be borne by public agencies. The proponent will coordinate with the BWSC, MDPW, MDC, and the MBTA in the design and construction of new storm drainage facilities.

Table IV-J-3

COMPARISON OF EXISTING AND FUTURE PEAK DISCHARGE RATES AND RUNOFF VOLUMES

Area	Existing Peak Discharge Rate (Cubic Ft./Sec.)	Future Peak Discharge Rate (Cubic Ft./Sec.)	Net Difference Cubic Ft./Sec.)
To Combined Sewers:			
Area A	22.7	0.7	(22.0)
Area B	3.5	0.1	(3.4)
Subtotals	26.2	0.8	(25.4)
To Storm Drains:			
Area C	3.7	3.6	(0.1)
Area D	3.2	3.2	-
Area E	4.1	27.1	23.0
Subtotals	11.0	33.9	22.9
TOTAL PROJECT	37.2	34.7	(2.5*)

* Decrease is due to the changes in individual drainage areas and time of concentrations under Existing and 2000 Full-Build conditions.

A number of other mitigation measures are proposed including the construction of an oil/water separator. The stormwater runoff from the parking area north of the New Boston Garden will be collected by a series of catch basins. This parking area will be primarily used by the New Boston Garden for vehicle turnaround and access during arena events. This runoff will be directed to a new oil/water separator prior to discharge to the new 42-inch drain line. Oil/water separators are precast concrete vaults which allow for the separation of gas, oil, and grease associated with parking lot runoff. Rather than being discharged to the Charles River, the removed oil, gas, and grease will remain within the vault while the "separated" stormwater passes through the remainder of the system. In accordance with accepted criteria for the design of these structures, the separator proposed for the new 42-inch drain line will be designed to hold a five-year, one-hour storm. The installation of an oil/water structure, in combination with the construction of the new 42-inch drain line will have a positive impact on the quality of the stormwater discharge to the Charles River by comparison to Existing conditions.

As a result of the construction of the New Boston Garden Arena, the quantity of stormwater runoff to the combined sewer system will be significantly reduced, due to a reduction in areas draining to the combined sewers. This stormwater is a part of the infiltration and inflow (I/I) problem that exists in the older sewerage systems. Later in this chapter an analysis is provided of the inflow that currently enters the system from the site and the reduction in stormwater inflow due to the new storm drainage system. A total stormwater inflow reduction of 1.958 mgd is achieved by the project. This is achieved by reducing 0.471 mgd to the WSI and 1.487 mgd to the NSO. The stormwater inflow reduction will result in decreased pumping and treatment costs in both the BWSC and MWRA systems. This benefit to the BWSC and MWRA systems is discussed in the following section (Sanitary Sewer Systems).

The redirection of drainage from the combined sewers to the Charles River will result in a small increase in stormwater runoff from the site into the Charles River. This relatively small increase is not anticipated to have an impact on the Charles River for the following reasons:

- The total increase in volume from the site is minor compared to the total volume of the Charles River.
- The peak discharge for the New Boston Garden site will occur well before the peak discharge for the Charles River. This means that the majority of the drainage from the site will leave the site, enter the Charles River, flow through the New Charles River Dam, and into Boston Harbor well before any appreciable increase in the flow from the Charles River basin.

SANITARY SEWER SYSTEM

Existing Conditions

Local sanitary sewer service in the City of Boston is provided by the BWSC. Sewage generated at the existing project site is collected by the BWSC's West Side Interceptor (WSI) in Causeway Street which connects with the MWRA's Boston Main Drainage Tunnel (BMDT) at Camden Street and Huntington Avenue. The BMDT flows under Boston Harbor and discharges to the Deer Island Treatment Plant. There the sewage is treated and ultimately discharged to Boston Harbor (see Figure IV-J-3). This section describes the BWSC collection system and the MWRA collection and treatment systems. The description of Existing conditions is followed by an evaluation of probable project impacts and a list of mitigation measures.

Boston Water and Sewer Commission (BWSC) Collection System

The BWSC owns and operates the wastewater collection system for the City of Boston. The BWSC system consists of 1,336 miles of combined sewers, sanitary sewers, and storm drains. Approximately 20 percent of the collection system is comprised of combined sewers. The 1985 Boston Wastewater Facilities Plan prepared for the BWSC concluded that the system is generally in good condition with most of the system able to handle present and future flows.

The following provides a description of the portions of the BWSC system that will be affected by the project.

***West Side Interceptor*.** Currently, sewage leaving the site from Boston Garden and 150 Causeway Street enters a 32-inch by 60-inch combined sewer in Causeway Street. This line is known as the West Side Interceptor (WSI) (see Figure IV-J-3). The WSI will also collect future sewage flows from the project.

The WSI begins in Boston's North End area under Commercial Street and runs along Causeway Street past the project area. It then continues in a southwesterly direction through the Back Bay and eventually ties into the Boston Main Drainage Relief Sewer, where it connects to the MWRA system. The size of the WSI varies from 32 inches by 54 inches at its beginning to 90 inches by 92 inches at its end. According to conversations with BWSC, the pipe in the vicinity of the project currently flows about half-full.

In 1985, the WSI was evaluated as part of the Boston Wastewater Facilities Plan (BWFP). This report indicates that the WSI was in good structural condition, but its capacity had been reduced because of sediment build-up. The report recommended that the sewer line be cleaned to increase capacity, and this work was completed by BWSC in 1986. According to BWSC, it has not experienced problems with this line since it was cleaned. There are currently no additional planned improvements to the WSI.

According to the BWFP, the WSI has adequate peak dry weather flow capacity to the year 2010. The WSI, however, does not have the capacity to carry wet weather flow. During storm conditions, due to the inflow of stormwater runoff, the combined sewage overflows to the MWRA collection system. This combined sewage is then treated and released at the MWRA treatment facilities. A detailed discussion of these overflows is provided under the Combined Sewer Overflows portion of this section.

The WSI in Causeway Street will undergo changes during both the Central Artery and the Green Line relocation projects. This will not have an effect on the project as the site's sewer service connection occurs further downgradient of these projects. Under current plans, the WSI will undergo the following changes:

- The Central Artery depression proposed by the MDPW will require the removal of the section of WSI that is within its limits. This project will require the relocation of the eastern end of the WSI and it is anticipated the work will be part of the Central Artery project. The portion of the WSI east of the Central Artery will be relocated down Medford Street where it will connect to the East Side Interceptor by way of the Canal Street Relief Sewer. The East Side Interceptor is a BWSC interceptor sewer which roughly parallels the Central Artery traveling from north to south. Similar to the WSI, it connects to the Boston Main Drainage Tunnel. It is connected to the West Side Interceptor by the Canal Street Relief Sewer (see Figure IV-J-1). The Canal Street Relief Sewer acts as a relief sewer between the WSI and the East Side Interceptor. It diverts flow from the WSI to the East Side Interceptor to prevent the WSI from overflowing. The relocation described above will result in the WSI beginning at the intersection of Haverhill Street and Causeway Street west of the new Central Artery.

- Subsequent to the relocation described above, the MBTA will relocate the Green Line which will shift a portion of the WSI from the intersection of Haverhill Street and Causeway Street to the intersection of Canal Street and Causeway Street. Again, it is anticipated the MBTA Green Line project will include the necessary WSI work.

A general description of these projects is provided in Chapter IV-N, Construction.

Nashua Street Overflow Sewer (NSO). The NSO is a combined sewer which collects the stormwater overflow from the West Side Interceptor by way of the Canal Street Relief Sewer. The NSO begins as a 72-inch by 90-inch sewer at the end of the Canal Street Relief Sewer on Causeway Street in front of the GSA Building and runs under the GSA Building north under Nashua Street. The NSO ends at the Charles River where it connects into the MWRA system.

Prior to the connection with the MWRA system, the NSO was able to discharge into the Charles River through the combined sewer outfall known as BOS #49. According to the BWSC, BOS #49 has a high weir which is set at an elevation of Elevation 9 (NGVD). The weir prevents all but extreme storms from overflowing into the Charles River. Based on conversations with the BWSC, there are no known capacity or structural problems with this line and no improvements are planned for this line at this time.

Massachusetts Water Resource Authority (MWRA) Collection System

The NSO and the WSI connect into the MWRA collection system. This collection system conveys the combined sewage to one of three treatment facilities--Deer Island Treatment, Cottage Farm Chlorination Facility (CFCF), or the Charles River Estuary Pollution Control Facility (CREPCF).

The point at which the WSI connects to the Boston Main Drainage Relief Sewer is the beginning of the MWRA system. Sewage from the project site enters the MWRA system at this point and then flows to the Ward Street headworks. This then connects to the Boston Main Drainage Tunnel which, after passing under the Columbus Park headworks, flows to the Deer Island Treatment Plant.

Upstream of this connection, the WSI has overflows to the NSO, which is maintained by BWSC, and to the Boston Marginal Conduit, which is maintained by the MWRA. During storm flow conditions, the WSI surcharges and overflows at these points. Both the NSO and the Boston Marginal Conduit convey combined sewage to the CREPCF for treatment prior to release to Boston Harbor. The operation of the CREPCF is described later in this section.

During extreme wet weather, flows proceeding to Deer Island in the Boston Main Drainage Tunnel are "choked" back at the Columbus Street Headworks. This is because the existing Deer Island Treatment Plant does not have the capacity to process the increased flow. The restriction placed on the sewage at the Columbus Street Headworks causes the combined sewage to back up to the Ward Street Headworks and then to the CFCF. The CFCF allows solids to settle, then removes grease and chlorinates the sewage prior to pumping the effluent to the Charles River.

Massachusetts Water Resource Authority (MWRA) Treatment Systems

The project site contributes flow to three MWRA treatment systems--the Deer Island Treatment Facility, CREPCF, and the CFCF.

Deer Island Treatment Facility. The Deer Island Treatment Plant is designed to treat an average daily flow of 343 million gallons per day (mgd) and a peak daily flow of 848 mgd. Current average daily and average peak flow are 343 mgd and 780 mgd, respectively. The plant currently provides only primary treatment prior to discharging the effluent to Boston Harbor.

The MWRA is constructing a new primary and secondary wastewater treatment facility at Deer Island which will replace the existing facility. The new plant will provide treatment for sewage currently being treated at the existing Deer Island and Nut Island treatment plants. The primary plant, which will improve treatment and increase capacity, is scheduled for completion by 1995. The secondary plant, which will increase the level of treatment to meet federal standards, is scheduled to be operational by 1999. The peak flow capacity of the new plant will be increased 50 percent in capacity by 422 mgd to a new peak flow capacity of 1.27 billion gpd.

Charles River Estuary Pollution Control Facility (CREPCF). The CREPCF is an MWRA facility that became operational in 1980. Its main function is to treat combined sewage flows prior to discharge to Boston Harbor. The plant's operations change depending on the type of flow condition (i.e., dry weather versus wet weather). Below is a description of how it operates under different flow conditions (see Figure IV-J-2).

- Dry weather flow from Boston, Cambridge, and Somerville enters the facility and is pumped to a 29-inch by 37-inch MWRA sewer which connects to the Charlestown Pump Station. The flow is then pumped to Chelsea Creek Headworks and ultimately, to Deer Island. This flow is generally between 2 to 3 mgd.

- Wet weather flow exceeding 5 mgd goes to eight sedimentation tanks where solids settle, grease is removed, and sewage is chlorinated. The effluent is then pumped to Boston Harbor near the New Charles River Dam.

- Wet weather flow in excess of the Deer Island Treatment Facility capacity of 323 mgd would go untreated to the Charles River by way of Millers River, located between the New Charles River Dam and the old dam at the Museum of Science. According to the MWRA, such an excess flow has never occurred.

The facility currently operates as designed and there are no known problems with capacity.

Cottage Farm Chlorination Facility. While the CFCF is not directly impacted by the project, the CFCF is utilized during extreme wet weather flows that exceed the Deer Island Treatment Plant's capacity.

The CFCF operates in a manner similar to the CREPCF in that it is exclusively used to treat overflows during wet weather flows. It allows solids to settle, grease to be removed, and sewage to be chlorinated prior to discharge into the Charles River.

Combined Sewer Overflows (CSO)

Prior to the construction of separate sanitary sewerage and storm drainage systems, the City of Boston's sewer systems conveyed sewage and storm drainage in the same pipe system. These systems were referred to as combined sewer systems. During storm conditions, the combined sewer system surcharged and overflowed to either Boston Harbor or other water bodies that drain to the harbor. A sewer surcharges when it is required to carry a flow in excess of its capacity.

Combined sewer overflows (CSOs) are outlet points in both the BWSC and MWRA systems that were initially designed to operate during storm events. They provide relief to the combined sewer system during storm flow conditions when the capacity of the sewer system is exceeded. The BWSC and MWRA are currently studying the elimination of these overflows.

There are two BWSC overflows (CSOs) which are located downgradient of the project site. These are CSO #49 and CSO #50. These CSOs and all other CSOs within 1/2-mile of the site are shown in Figure IV-J-5. CSO #49, located off Nashua Street adjacent to the MDPW heliport, drains to the Charles River. CSO #50, located off Beverly Street, drains to Boston Harbor.

The Boston Marginal Conduit (BMC) is an MWRA line which parallels the Charles River and flows to the CREPCF. The BMC collects overflows from BWSC combined sewer systems including the WSI. There are several CSO's along the BMC, which outlet to the Charles River. According to the MWRA, there have been no known discharges from these CSOs. The BMC collects overflows and conveys these flows to the CREPCF.

The MWRA has been evaluating existing combined sewage overflow (CSO) conditions. A Draft Facilities Plan and Draft Environmental Impact Report was filed with MEPA on December 31, 1989. These reports provide a program to control pollution caused by CSOs. The program includes the construction of deep tunnels for storage of wet weather flows and subsequent pumping to the Deer Island facility for treatment.

Project Sewage Flows

The existing sewage flow from the project site is estimated to be 100,800 gpd (see Table IV-J-4). This flow was estimated based on the Massachusetts Department of Environmental Protection (DEP) regulation 310 CMR 15.00 "The State Environmental Code, Title V." The flows expressed in the regulations represent maximum daily flows. Average daily flows are 50 percent of the maximum daily flow. These flows are shown in Table IV-J-4.

Infiltration/Inflow (I/I)

Infiltration is extraneous flow entering the sewerage system through leaks and cracks in the pipes or pipe joints, and in some areas of the system, would include tidal flow back-ups into the pipes. Inflow is defined as stormwater from a one-year, six-hour storm that enters the sewerage system through a direct connection of a roof leader, catchbasin, or storm drainage system. The existing project site contributes a large amount of stormwater (inflow) to the NSO and the WSI.

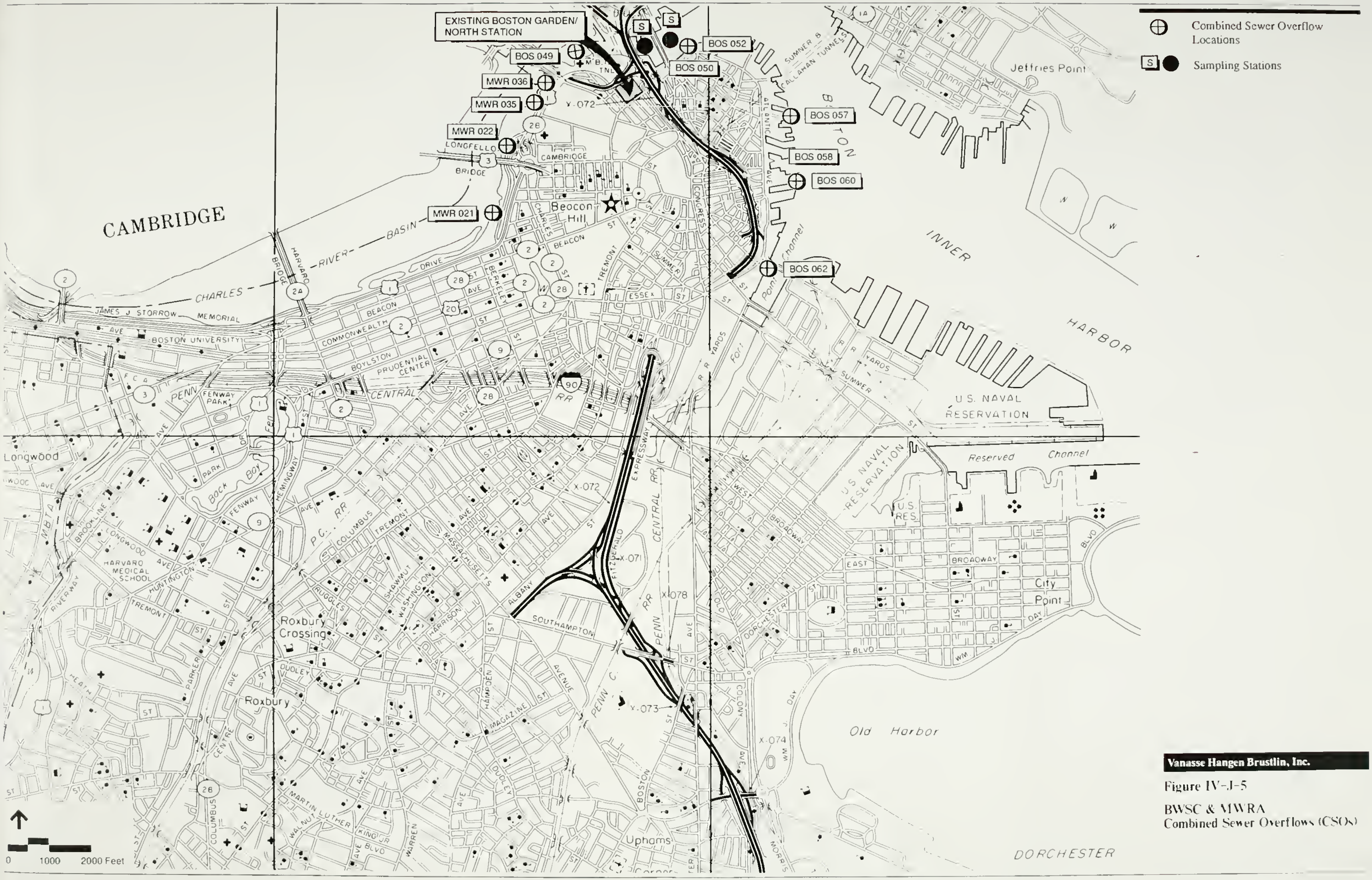


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Figure IV-J-5

BWSC & MWRA
Combined Sewer Overflows (CSOs)

Table IV-J-4 **EXISTING WASTEWATER GENERATION**

Use	Size	Rate*	Sewage Flow Estimates (gpd) Maximum Daily (gpd)	Average Daily	Peak Flow
Boston Garden:					
Arena	14,890 seats	3 gpd/seat	44,670	22,335	122,843
Restaurant	520 seats	35 gpd/seat	18,200	9,100	50,050
150 Causeway Street:					
Office	450,000 SF	75 gpd/1,000 sf	33,750	16,875	92,812
Restaurant	120 seats	35 gpd/seat	4,200	2,100	11,550
TOTAL			100,800	50,400	277,300

* Based on DEP regulation 310 CMR 15.00.

Removal of I/I from existing systems is an ongoing objective of the MWRA and the BWSC. In the past, the Secretary of Environmental Affairs has supported BWSC's and MWRA's objective of I/I removal from the existing systems by requiring a 2:1 ratio of I/I removal for certain projects in urban areas. The removal of I/I reduces the incidences of combined sewer overflows (CSOs) as well as the volume of CSO to receiving waterbodies. By removing I/I from CSO systems, the capacity and ability for the system to handle sewage is increased. The treatment facilities' capacity to treat the sewage effluent is increased, because the facility is not overburdened by extraneous stormwater drainage. As part of the I/I removal for this project, the most effective solution providing the maximum benefit is the separation of stormwater drainage from the combined sewer system. The proposed project design includes provisions for construction of major and separate drainage lines which divert and separate the stormwater flow from the sewage flow. The result is an I/I removal ratio that greatly exceeds the 2:1 ratio the Secretary of Environmental Affairs has previously held as a standard for certain projects in urban areas.

The existing quantity of inflow was computed based on criteria established by the Department of Environmental Protection, Division of Water Pollution Control (DWPC). DWPC has formulated an I/I rehabilitation program which indicates procedures for the evaluation of I/I. The procedures estimate peak inflow using the Rational Formula with a one-year, six-hour storm event. Using the information obtained in the Existing conditions drainage analysis and the DWPC procedures, the peak inflow was estimated to be 5.7 cubic feet per second (cfs) entering the NSO and WSI. This is equivalent to an average daily flow of 3.7 mgd. A breakdown of this analysis is provided in Table IV-J-5.

Table IV-J-5 **EXISTING STORM INFLOW TO COMBINED SEWERS**

Combined Sewer	Runoff Coeff.	Rainfall Intensity (in/hr)*	Drainage Area (Acres)**	Inflow cfs/mgd)***
Nashua Street Overflow	0.90	0.87	6.31	4.941/3.193
West Side Interceptor	0.90	0.87	0.96	0.752/0.486
TOTAL			7.27	5.693/3.679

* From the Massachusetts Department of Environmental Protection (DEP) "Guidelines for Performing Infiltration/Inflow Analyses and Sewer System Evaluation Survey", rev. July 1989, pg. 9. The one-year, six-hour design storm has a peak rainfall intensity of 0.87 inches per hour.
** From Drainage Calculations in Storm Drainage System section.
*** mgd = cfs x 0.646 mgd/cfs.

Probable Project Impacts

The 2000 Full-Build condition will generate a maximum daily sewage flow of approximately 266,692 gpd. This estimate is based on sewage flow estimates found in DEP regulation 310 CMR 15.00, "The State Environmental Code, Title V." A breakdown of the estimated wastewater generation by the project is presented in Table IV-J-6.

Table IV-J-6 **2000 FULL-BUILD CONDITIONS WASTEWATER GENERATION**

			Sewage Flow Estimates*		
Use	Size (SF)**	Rate***	Maximum Daily	Average Daily	Peak Flow
NEW BOSTON GARDEN			95,442	47,721	262,466
BUILDING A:					
Office	450,000	75 gpd/1,000 sf	33,750	16,875	92,813
BUILDING B:					
Office	844,000	75 gpd/1,000 sf	63,300	31,650	174,075
Retail	39,000	5 gpd/100 sf	1,950	975	5,363
BUILDING C:					
Office	956,000	75 gpd/1,000 sf	71,700	35,850	197,175
Retail	11,000	5 gpd/100 sf	550	275	1,513
TOTAL PROJECT FLOW			266,692	133,346	733,405

* Gallons per day.
** Square feet.
*** Based on DEP Regulation 310 CMR 15.00.

At the project team's initial meeting with the BWSC, the proponent was requested to connect the project's sewage system into the WSI. As part of the joint agreement between the proponent and the MBTA, a new sewer line will be installed by the MBTA in Cotting Street (see Figure IV-J-6). This new sewer line will be utilized for the New Boston Garden and Building A service connection. Buildings B and C will also connect to the WSI by separate sewer connections in Causeway Street.

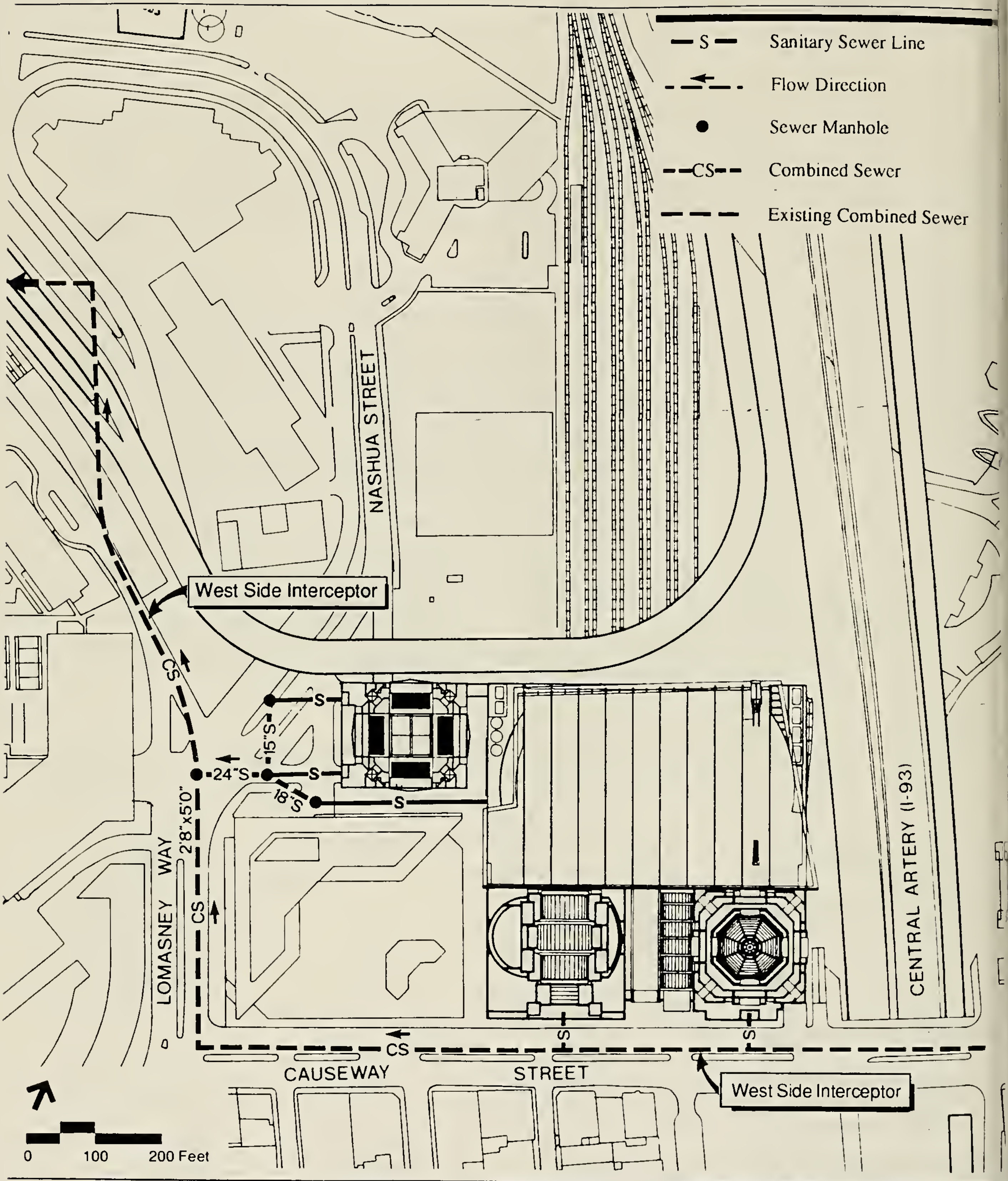
The proponent, as requested by the BWSC, will provide a new storm drainage line that will divert site stormwater runoff from the combined sewers to a new outlet in the Charles River. This will reduce the inflow entering into the BWSC and MWRA systems from the project site. Table IV-J-7 shows the inflow that will be entering the system after completion of the New Boston Garden (1993) and under 2000 Full-Build conditions.

An objective of the infrastructure design of the project is to provide a significant reduction of the stormwater inflow into the combined sewer systems, WSI and NSO. Table IV-J-8 shows a comparison of the sewage generated by the project elements and the sewage and stormwater inflow removed from the sewer systems as a result of the proposed development. The net reduction of the stormwater into the WSI and NSO is calculated from the difference of the existing inflow shown in Table IV-J-8 and the proposed storm inflow rates shown in Table IV-J-7. The results shown in Table IV-J-8 clearly demonstrate the positive impacts or benefits that both the construction of the arena only and the construction of the 2000 Full-Build conditions will have on the combined sewer system flows.

Table IV-J-7 **PROPOSED STORM INFLOW TO COMBINED SEWERS**

Combined Sewer	Runoff Coeff.	Rainfall Intensity (in/hr)*	Drainage Area (Acres)	Inflow cfs/mgd)
1993 Build Conditions (Arena Only):				
Nashua Street Overflow	0.9	0.87	3.37	2.639/1.706
West Side Interceptor	0.9	0.87	0.03	0.023/0.015
2000 Full-Build Conditions:				
Nashua Street Overflow	0.9	0.87	0.14	0.101/0.065
West Side Interceptor	0.9	0.87	0.03	0.023/0.015

* From DEP guidelines on I/I.



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Project Sewer Connection

Figure IV-J-6

Table IV-J-8 COMPARISON OF WASTEWATER AND INFLOW QUANTITIES FROM PROJECT

	West Side Interceptor (WSI)*			Nashua Street Overflow (NSO)*			WSI and NSO*
	Wastewater	Inflow	Total	Wastewater	Inflow	Total	Total
1990 Existing Conditions							
Sewage and Inflow Generated	0.101	0.486	0.587	-	3.193	3.193	3.780
1993 Arena Only							
Sewage Generated	0.095	-	0.095	-	-	-	0.095
Sewage and Inflow Removed	(0.101)	(.471)	(0.572)	-	(1.487)	(1.487)	(2.059)
Net Reduction:	(.006)	(.471)	(.477)	-	(1.487)	(1.487)	(1.964)
2000 Full-Build Conditions							
Sewage Generated	0.267	-	0.267	-	-	-	0.267
Sewage and Inflow Removed	(0.101)	(.471)	(.572)	-	(3.128)	(3.128)	(3.70)
Net Reduction:	.166	(.471)	(.305)	-	(3.128)	(3.128)	(3.433)

* In mgd.

The sewage generated by the project will be collected entirely by the WSI. With construction of the 2000 Full-Build conditions, 266,692 gpd of sewage will be generated while the project will remove 470,640 gpd of stormwater inflow and 100,800 gpd of sewage from the existing arena. This produces a positive reduction in flow to the WSI of 571,440 gpd while adding to the system only 266,692 gpd. Thus, will have a positive impact on the WSI because the total flow entering the system upon completion of the project will be significantly reduced to one-half of the current flow from the site.

As important is the positive impact the 1993 Build conditions (arena only) and the 2000 Full-Build conditions will have on the NSO. Both Build conditions significantly reduce the storm inflow into this combined sewer.

Mitigation Measures

The project will provide mitigation that will decrease the flow of storm drainage to the WSI and NSO. This decrease is a result of the diversion of site runoff from the combined sewer to a new on-site storm drainage system. This will result in a net decrease between the existing conditions flow and both the 1993 Build conditions (Arena Only) and the 2000 Full-Build condition flows.

During the construction of the New Boston Garden Arena, the proponent will construct a new 48-inch storm drain line to the Charles River. This storm drain line will be sized to convey all the storm drainage from the site except a few small areas that will continue to drain to other systems. The project site currently generates 100,800 (i.e., 0.101 mgd) gpd of sewage and 3.679 mgd of inflow for a total of 3.780 mgd. Construction of the drainage systems proposed will allow 1.958 mgd of stormwater runoff to be eliminated from the combined sewer systems.

The construction of the 1993 Build conditions (Arena Only) will result in a net decrease of 1.964 mgd of sewage and inflow to the BWSC combined sewer system by the demolition of the existing buildings and the redirection of site stormwater runoff to the new storm drainage system (see Table IV-J-8). The ratio of wastewater and inflow removed to wastewater generated will be 21:1. Construction of the New Boston Garden arena will substantially reduce infiltration and inflow problems in the area's combined sewers by removing a volume of stormwater from the system that far exceeds the amount of new sewage.

The 2000 Full-Build conditions will also result in a net decrease of flow to the BWSC combined sewer system. The project will result in a decrease of 3.433 mgd of sewage and inflow between Existing and 2000 Full-Build conditions. The ratio of wastewater and inflow removed to wastewater generated will be over 13:1.

The removal of the inflow that currently flows to the combined sewer system for both the 1993 Arena Only and the 2000 Full-Build conditions will have a significant positive impact to both the MWRA and BWSC systems. It is consistent with the previous desires of the Secretary of Environmental Affairs on similar projects to reduce inflow into the sewerage system and greatly exceeds the Secretary's objective of 2:1 ratio of I/I removal for urban development projects. At no point in the project build-out will there be an increase in flow to either the WSI or the NSO.

As a result of these specific mitigation measures, the environment benefits significantly in the following ways:

- Water quality of the receiving waters (i.e., the Charles River) is improved, since sewage is treated properly at treatment facilities not overburdened with extraneous flows from stormwater.
- Incidence and volume of combined sewer overflows are reduced.
- Stormwater runoff with the measures provided is pre-treated through oil/water separators thereby enhancing water quality from bus parking area runoffs.
- Replacement of surface parking with underground parking and provision of more roof than surface paving provides a "cleaner" stormwater runoff.
- The existing stormwater drainage systems will be cleaned and maintained.
- System maintenance on an ongoing basis as part of the building operation will contribute to enhanced water quality.

- I/I removal greatly exceeds the Secretary of Environmental Affairs previous request of 2:1 ratio of I/I removal for urban development projects.

The proponent will coordinate with the BWSC, MWRA, MDC, MDPW, and the MBTA in the design and construction of new sanitary sewers.

In summary, the mitigation proposed to be included with the project provides a significant positive environmental impact to the project area and BWSC and MWRA systems.

WATER SUPPLY SYSTEM

Existing Conditions

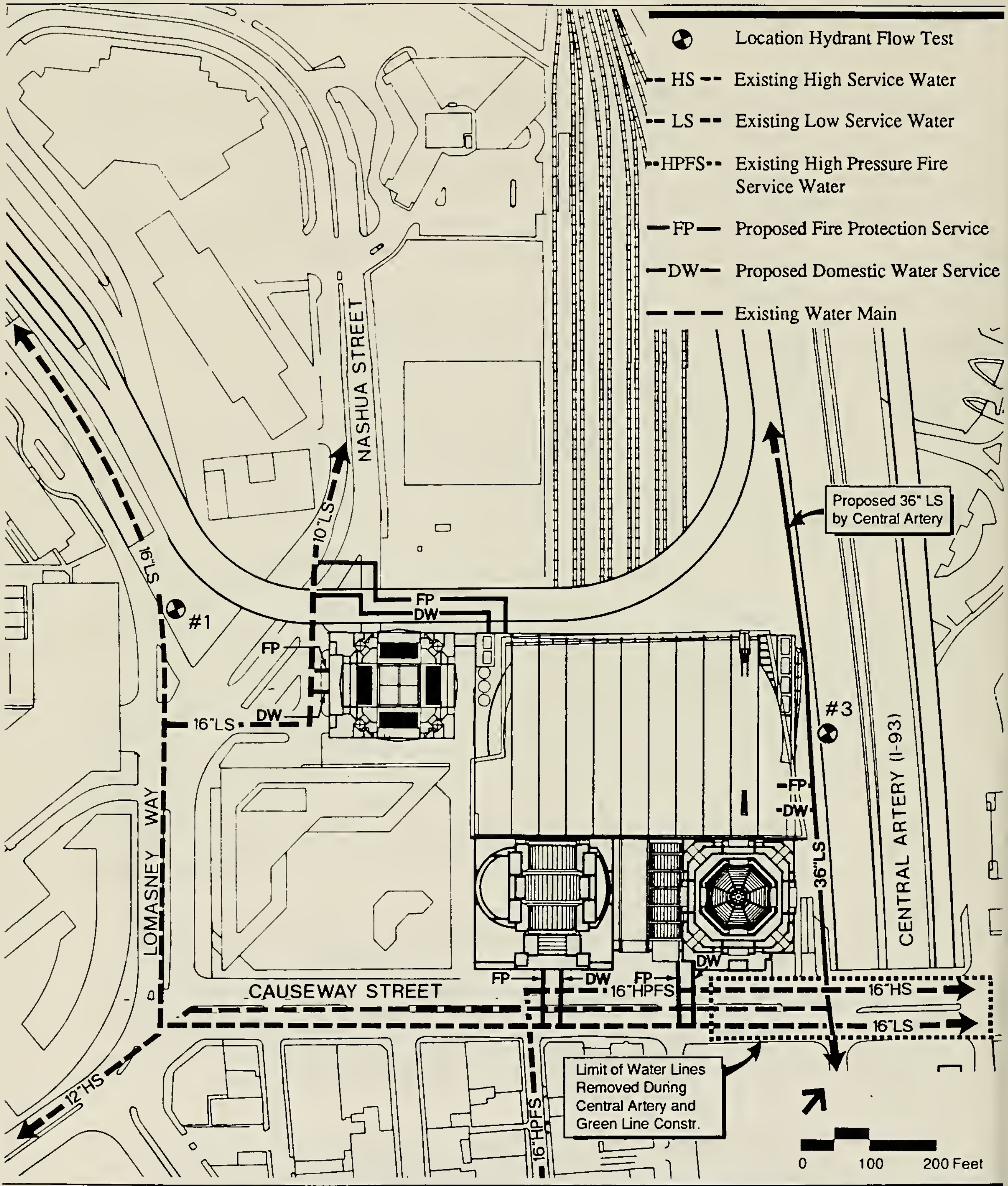
Water service is provided by the BWSC through the MWRA system which supplies water to forty-six communities in eastern and central Massachusetts. The MWRA is responsible for the treatment, transmission, and sale of water to these communities.

There are two main reservoirs which serve as water sources for the MWRA system--the Quabbin Reservoir located in central Massachusetts and the Wachusett Reservoir located north of Worcester, Massachusetts. Prior to the Quabbin Reservoir coming on line, water was supplied by the Sudbury Reservoir located in Sudbury, Massachusetts. This reservoir is presently used for emergency purposes only. The combined safe yield of both the Quabbin and Wachusett reservoirs is 300 million gallons per day. The safe yield is defined as a quantity of water that can be supplied on a continuous basis with desired reliability. The MWRA has stated there is sufficient present and future supply for the region, although this was not always the case. From the late 1960s through the 1970s and into the early 1980s, the safe yield of the system had consistently been exceeded. The MWRA and the communities that they serve have initiated an aggressive leak detection and water line improvement program. According to MWRA, this, combined with a water conservation program and higher water fees, has resulted in a continual drop in water demand through the latter part of the 1980s.

The City of Boston has five different water systems and five service districts within the city. These systems supply water to portions of the city based on ground surface elevation. These are southern low (commonly known as low service), southern high (commonly known as high service), southern extra high, northern low, and northern high. In addition, there is a high pressure fire service district system, which provides high pressure (300 psi) to the downtown Boston area for use during a fire emergency. This line only supplies water to certain hydrants in the city.

Three of the City of Boston's water distribution systems serve portions of the project. These are the (southern) low service system (LS), the (southern) high service system (HS), and a high pressure fire service system (HPFS) (see Figure IV-J-7). The Boston Garden and 150 Causeway Street are currently serviced from the low service system.

In July and August of 1990, hydrant flow tests to determine actual flows and pressures in the project area were performed by the BWSC. As described in greater detail below, the test results show there is adequate flow and pressure in


Location Hydrant Flow Test
HS Existing High Service Water
LS Existing Low Service Water
HPFS Existing High Pressure Fire Service Water
FP Proposed Fire Protection Service
DW Proposed Domestic Water Service
Existing Water Main
NASHUA STREET
10"LS
16"LS
#1
FP
DW
FP
DW
16"LS
LOMASNEY WAY
CAUSEWAY STREET
12"HS
16"HPFS
FP
DW
FP
16"HPFS
DW
16"HS
16"LS
36"LS
FP
DW
#3
CENTRAL ARTERY (I-93)
Proposed 36" LS by Central Artery
Limit of Water Lines Removed During Central Artery and Green Line Constr.
0
100
200 Feet

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Project Water Connection

Figure IV-J-7

the area of the project site to service the proposed project. The results of the hydrant test are indicated in Table IV-J-9. Flow tests were taken on Lomasney Way, Commercial Street, and Beverly Street. Two of the flow tests were on the low system, and one test was on the high system.

Table IV-J-9 **HYDRANT FLOW TESTS**

Test Number	Location	System	Static (psi)	Residual (psi)*	Flow (gpm)**	Approximate Quantity @ 20 psi (gpm)
#1	Lomasney Way	LS	58	47	2,799	5,466
#2	Commercial Street	LS	57	48	4,752	10,195
#3	Beverly Street	HS	90	73	2,817	6,048

* Pounds per square inch.
** Gallons per minute.

The results of the hydrant flow tests indicate the actual amount of water (flow) available and the actual pressure (residual) flow provided. These numbers are analyzed to establish the quantity of water that will be delivered at 20 psi.

Causeway Street Water Relocation

New HS, LS, and HPFS water lines will be constructed with the Central Artery project to allow a portion of the existing lines in Causeway Street under the Central Artery to be discontinued. The new lines will connect with pipes in Causeway Street on the east side of the Central Artery, run down Medford Street, across Traverse Street, and along Canal Street where they will connect back to the existing lines in Causeway Street on the west side of the Central Artery.

In addition, a new 30-inch LS water line will be constructed in Haverhill Street and will end just south of the Anelex Building. Upon the demolition of the Anelex Building, a new 36-inch LS will be rerouted from the new Causeway Street 30-inch LS along Accolon Way, and will connect to the existing 36-inch LS in the vicinity of the Charles River.

Probable Project Impacts

New Boston Garden

The New Boston Garden will be serviced by the BWSC low service system. Domestic and fire service will be provided by two independent services (see Figure IV-J-7). This will allow the New Boston Garden to continue to operate if one of the service lines is disconnected. One service will tie into a proposed 16-inch main in Nashua Street, which will be installed under the MBTA garage project. The other service will be from the existing 16-inch main in Causeway Street. The New Boston Garden's expected maximum daily water demand will be 95,422 gpd (see Table IV-J-10). The peak domestic flow demand will be 700 gpm, and the required fire flow demand will be 2,500 gpm at 20 psi. Based on the results of the hydrant flow tests, there is adequate capacity in the BWSC water lines to service the project.

Based on this analysis, the New Boston Garden will not have an impact on the water supply distribution system. As shown, in Table IV-J-10, the 1993 Build Conditions (Arena Only) will require less water than the existing development on the project site (i.e., Boston Garden, Anelex Building, and the restaurant).

Commercial Component

The proposed commercial component will be serviced by the water lines in Causeway Street and Nashua Street. The commercial component will have a maximum daily demand of 171,250 gpd (see Table IV-J-10) and the project team's discussion with BWSC confirms there is adequate water supply to service the New Boston Garden and the commercial component. It anticipated that the peak domestic flow for Buildings A, B, and C will be 1,050 gpm, and the required fire flow demand will be 1,500 gpm at 20 psi for each building. Based on the results of the hydrant flow test, there is adequate pressure and flow to service both the New Boston Garden and the commercial component.

Mitigation Measures

The State Building Code requires the use of water-conserving fixtures. Table IV-J-10 showed future water demand for the project based on typical water usage rates for buildings and land developments. These demands do not account for the use of water-conserving fixtures. Although the impact of these fixtures is not quantified, their use will further reduce the water demand for the project as shown in Table IV-J-10. The proponent will coordinate with the BWSC and the MBTA in the design and construction of new water connections so as to minimize short-term construction-related disruptions in service.

New Boston Garden

The New Boston Garden is being designed to minimize water use. Consistent with the State Building Code, the New Boston Garden will use water-conserving fixtures. This will reduce the projected flows by comparison to the existing Boston Garden. To further minimize the facility's water demand as shown in Table IV-J-10, the mechanical system design will utilize air economizers. Air economizers use outside air in lieu of cooling towers during the spring and fall seasons to provide air conditioning. The cooling towers will require 120 gpm of water during the summer months to air condition the New Boston Garden. The use of air economizers to air condition the New Boston Garden during the spring and fall will result in a considerable reduction of the New Boston Garden water demand.

Table IV-J-10 EXISTING AND FUTURE WATER DEMAND

Use	Water Flow Estimates (gpd)* Maximum Daily	Average Daily	Peak Flow
EXISTING DEMAND			
Existing Project Site	100,800	50,400	277,200
FUTURE DEMAND			
New Boston Garden	95,422	47,711	262,411
Commercial Component			
- Building A	33,750	16,875	92,813
- Building B	65,250	32,625	179,438
- Building C	72,250	36,125	198,688
SUB TOTAL COMMERCIAL	171,250	85,625	470,939
TOTAL PROJECT	266,672	133,336	733,350
NET NEW DEMAND	165,872	82,936	456,150

* Based on DEP Regulation 310 CMR 15.00. This regulation provides typical water usage rates for various buildings and land development types. Water usage rates includes all water usage including potable water and air conditioning. Ice-making requires 10,000 gallons over a three-day period. This occurs four times in a year. Arena events are not scheduled during the ice-making, therefore, the daily water demand will not be effected.

Commercial Component

The commercial component has not proceeded past conceptual design at this point. As each building is designed, current water conservation measures will be evaluated and incorporated as appropriate in order to reduce water demand. As a minimum, the commercial component will be designed in accordance with the State Building Code which requires the use of water-conserving fixtures.

ENERGY SYSTEMS

Existing Conditions

Electric System

The Boston Edison company has an existing distribution network in Causeway Street which provides power to the area. Power to Boston Garden is provided by a service line that enters into the northwest corner of the building through the alley between the GSA Building and Boston Garden. The existing service consists of two 13kv lines. The current service is adequate for the existing Boston Garden. There are no problems associated with the transmission or service line.

Gas System

Gas service to the project site is provided by Boston Gas Company. A 12-inch gas supply line is located in Causeway Street and a 6-inch line is located in Nashua Street.

Service to the existing Boston Garden is provided from the Causeway Street line. There is currently adequate pressure and supply to service the existing facilities.

Probable Project Impacts

Electric System (New Boston Garden)

The New Boston Garden will be supplied by two 13KV lines from the Boston Edison distribution system in Causeway Street. The proposed electric demand for the arena is estimated to be 4,000 kilowatts. This demand is for the lighting and mechanical system, including the chillers for the air conditioning. The proposed service will be provided in the same location as the existing services. The project team has met with Boston Edison to evaluate the impacts to the electrical systems by the addition of the New Boston Garden. Boston Edison has assured the project that there is adequate power in the area to service the new arena and modifications to the electrical distribution system will not be necessary.

Electric System (Commercial Component)

The proposed commercial component will require approximately 24,000 kilowatts for power for Buildings A, B, and C. This will require an upgrade of the existing electric grid system. The project team is currently working with Boston Edison to initiate improvements that will be required to provide sufficient power for the commercial component. Boston Edison has indicated sufficient supply is available, but until actual power demands are known, the specific source of power to be used for the project and the upgrade to the existing electric grid system cannot be determined. Boston Edison is presently investigating the siting of a new substation in the North Station area in anticipation of future demands. Specific sites and details of the system upgrade are not available at this time.

Gas Systems (New Boston Garden)

The New Boston Garden currently proposes to utilize gas service for heating requirements. The proposed service to the New Boston Garden will be supplied through the gas line on Nashua Street. The existing gas service is not adequate to supply the New Boston Garden. The Boston Gas Company is currently reviewing their system to evaluate the upgrades that will be needed to provide service to the New Boston Garden by way of Nashua Street. The proponent has been assured by Boston Gas that there will be sufficient supply and pressure to service the arena once the upgrades are completed.

Gas System (Commercial Component)

The proposed office complex will utilize gas service on Causeway Street and Nashua Street. The proponent is currently studying the gas utilization options for the commercial component portion of the project. Since the design of the commercial component has not proceeded past the conceptual design stage, project specifics are not available.

Mitigation Measures

The proponent will coordinate with Boston Edison and Boston Gas in the provision of service to the development and to minimize construction-related disruptions to local area service. The following describes proposed mitigation measures for the New Boston Garden and the commercial component.

New Boston Garden

The proponent plans to initiate numerous energy conservation measures to reduce the energy requirements. Actions planned for include the following:

- Use of energy-efficient motors and transformers
- Use of High Intensity Discharge (HID) lighting which has a lower electric demand than conventional lighting
- Use of computerized lighting control which will automatically shut down lighting systems when their use is not required
- Energy-efficient lamps and ballast
- White reflective insulated roof with an R value of 15.5
- A low percentage of window-to-wall area (3 percent)
- An R value of insulation on walls typically in excess of 13.5
- Transition areas between the interior and exterior which will serve as "air locks"

Commercial Component

The design of the commercial component has not developed beyond the conceptual stage at this time. It is anticipated, however, that similar energy conservation measures will be incorporated into the commercial component as it is designed.

CONCLUSION

Based on this analysis, the development of the New Boston Garden and the commercial component will not have an adverse impact on the existing infrastructure systems. The demolition of the existing facilities and the improvements to the infrastructure proposed by the proponent will provide positive benefits to the project area. The most significant improvement will be the installation of a new storm drainage system which will provide a direct benefit to the MWRA and BWSC sewerage systems as well as improve the quality of stormwater that currently discharges to the Charles River and Boston Harbor. The new drainage system will remove a quantity of stormwater from the combined sewer system that is thirteen times greater than the sewage that will be generated by the full development of the project. This will have a positive impact to both the BWSC and MWRA systems. The existing on-site pavement runoff discharges directly to the Charles River and Boston Harbor, without oil, gas, or grease removal. The installation of an oil/water separator as part of the storm drainage system will provide removal of oil, gas, and grease from the on-site pavement runoff. This will provide a positive benefit to the water quality of the adjacent water bodies.

The project will also utilize the latest techniques in water and energy conservation measures. Bathroom fixtures will be selected and installed in accordance with the new State Building Code, and state-of-the-art air conditioning systems will greatly minimize the water demand that would have resulted with conventional systems. The use of computer-controlled electrical systems combined with energy-efficient equipment and high insulation values in the walls and roof will result in considerable energy savings.

K Water Quality

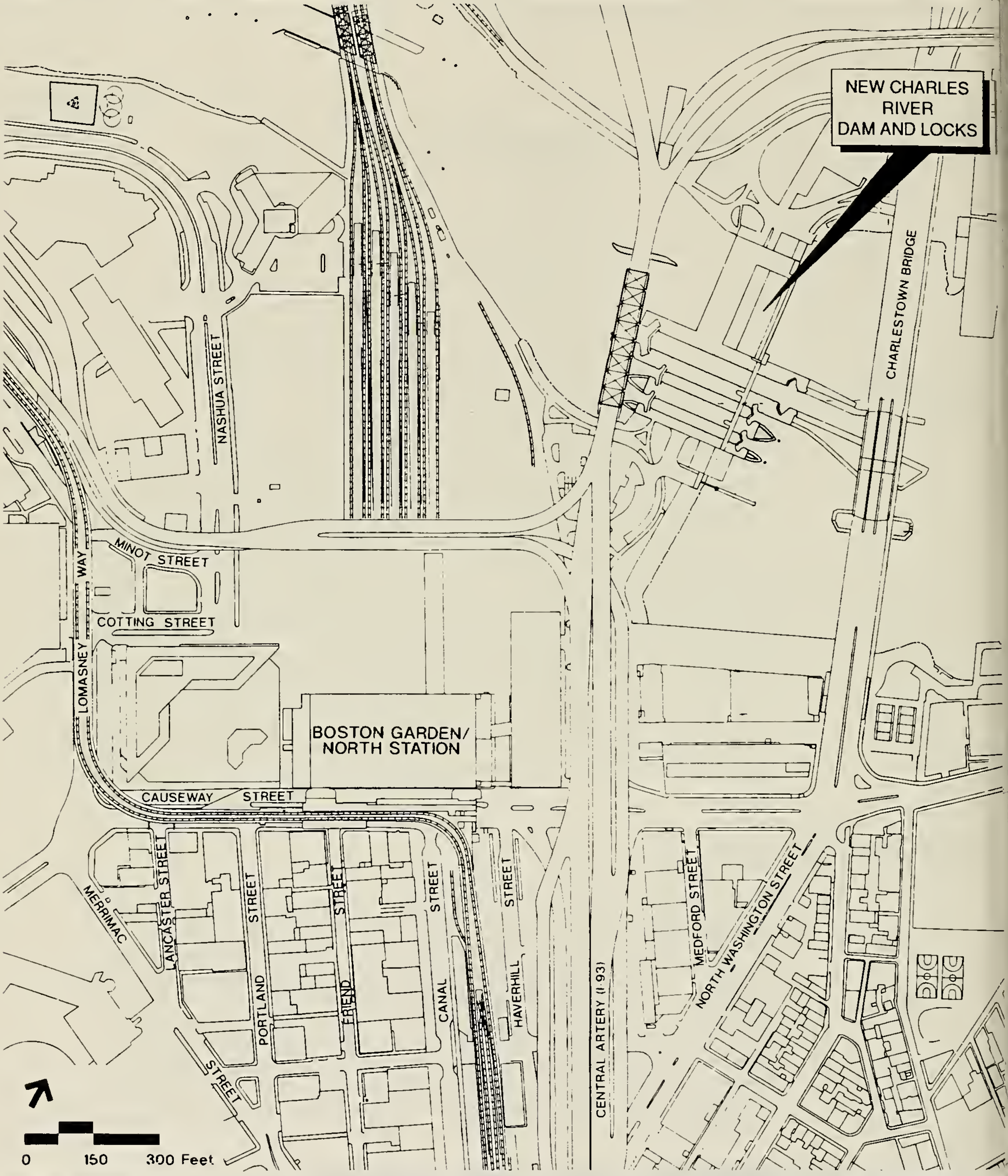
INTRODUCTION

This section reviews the existing water quality conditions in the Charles River and Boston Harbor and analyzes the long-term water quality effects of the proposed New Boston Garden Development. Construction-related effects and mitigation measures are also discussed. The principal effect of the project will be an improvement in the quality of stormwater discharges and a substantial reduction in the volume of such discharges to combined sewers. Excessive stormwater flows into combined sewers result in sewage release to receiving waters and consequent degradation of water quality. The project will provide separate storm sewers which will direct drainage to the Charles River and away from the combined sewers which currently serve the site, decreasing the volume of drainage to the combined sewers which is currently being generated on the site during storm events. As a result, the frequency and volume of treated combined sewer overflows to the Charles River and Boston Harbor will decrease. As a consequence of the drainage improvements associated with the project, the cleanup of the Charles River Basin and Boston Harbor will be positively affected.

AFFECTED ENVIRONMENT

The project site is located within the drainage area of the Charles River Basin, approximately 1,000 feet southwest of the New Charles River Dam (see Figure IV-K-1). The Charles River is approximately 70 miles in length and drains an area of approximately 265 square miles. The Charles River watershed is comprised of the land which drains to the Upper Charles River, the river segment from the headwaters in Hopkinton to the Watertown Dam, and the land draining to the Lower Charles River Basin. The Basin extends from the Watertown Dam to the New Charles River Dam at the Boston Inner Harbor. The area draining directly to the Lower Charles River Basin consists of approximately 42 square miles and includes portions of the cities of Watertown, Cambridge, Newton, Boston, and the town of Brookline.

Before the construction of the Old Charles River Dam at the Boston Museum of Science in 1908, the Basin was influenced by the rise and fall of the tide in the Boston Inner Harbor. The dam was constructed with locks and sluicegates to reduce the incidence of flooding in the areas adjacent to the Basin.



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Locus Map

Figure IV-K-1

In 1978, construction of a new dam just upstream of the Charlestown Bridge was completed through a joint effort of the Army Corps of Engineers and the Metropolitan District Commission. During flood events, the new dam incorporates both high- and low-level sluicegates and high-capacity pumps to pump water from the Charles River to the harbor.

In addition to flood control facilities, the new dam has a fish ladder, two recreational vessel locks, one commercial vessel lock, a visitors center and recreational facility, and a Metropolitan District Commission police boat facility.[1]

Freshwater from the Charles River flows continuously through the open locks of the Old Charles River Dam. The sluicegates of the New Charles River Dam allow water to flow into Boston Harbor during the major part of each tidal cycle (excluding the period near high tide). The mean annual flow into the harbor is 450 cubic feet per second (cfs)[2] and the seven-day, ten-year low flow is approximately 22 cfs. The Charles River is the major source of freshwater to Boston Harbor.

The Millers River is a small tributary of the Charles River which enters just upstream of the New Charles River Dam. The Millers River drains approximately 1,000 acres of Charlestown and serves primarily as a conduit for stormwater.

WATER QUALITY ANALYSIS

Physical Conditions in the Charles River Basin

Prior to 1990, when the Massachusetts Department of Environmental Protection, Division of Water Pollution Control (DEP/DWPC) reclassified the Charles River Basin as Class B, the Charles River Basin was the only freshwater river in Massachusetts with a Class C water quality classification. Class C waters are designated for secondary contact recreation (boating) and for the protection and reproduction of fish, aquatic life, and wildlife. Class B waters are assigned additional designated uses of primary and secondary contact recreation (fishing and swimming). Water quality criteria associated with the Class C and Class B designation are provided in Technical Data appendix. The classification of the Charles River Basin was upgraded to respond to public demands for the improvement of the water quality of this highly visible and recreationally significant water body.[3] The DEP/DWPC does not permit pollutant discharges which would result in water quality degradation of a water body currently in compliance with standards. However, based on the most recent year of comprehensive sampling (1988), the water quality of the Charles River Basin does not currently meet even Class C standards, due to excessive levels of coliform bacteria, petroleum hydrocarbons, and insufficient levels of dissolved oxygen.[4]

1/ Charles River Basin 1987, Part D: Water Quality Management Plan; DEP/DWPC (1988).

2/ Draft Supplemental EIR/EIS for the Central Artery/Tunnel Project; Commonwealth of Massachusetts Department of Public Works (1990).

3/ Telecommunication with Mr. Paul Hogan, director of the River Basin Monitoring Section, Massachusetts DEP, Division of Water Pollution Control (August 9, 1990).

4/ Commonwealth of Massachusetts Summary of Water Quality 1988; DEP/DWPC.

The principal sources of these problems are bacterial decay in bottom sediments and point sources of contaminants, primarily, combined sewer overflows. Combined sewers are collection systems which convey both sanitary sewage and stormwater runoff. These collection systems are designed to convey dry weather flows and a portion of wet weather flows to so-called interceptor sewers for delivery to wastewater treatment facilities. Regulation devices allow flows which exceed the capacity of the interceptor sewers to overflow to an adjacent water body; these overflows are called combined sewer overflows (CSOs).

The major source of petroleum hydrocarbons is surface runoff from paved roadways and parking areas. The proposed New Boston Garden Development will decrease the area of paved surfaces and increase the area of rooftop surfaces in the project area (see Chapter IV-J, Infrastructure), decreasing the potential loadings of petroleum hydrocarbons. Additional removal of hydrocarbons in runoff will be achieved by the installation of an oil/water separator to treat runoff from the portions of the site expected to receive the heaviest loadings.

Because of the impoundment of water at the New Charles River Dam, tidal flushing of the Basin does not occur, and fine-grained particulate material settles to the bottom. The sediments throughout the basin consist of a thick organic muck. Due to the presence of organic matter and suspended sediments in the water, sunlight penetrates only a short distance below the water surface. As a result, the production of oxygen during photosynthesis by algal populations is confined to the upper layer of the water column.

Natural mixing and diffusion of atmospheric oxygen into surface waters occurs slowly in the sheltered section of the basin between the old and new dams. Bacterial respiration in the sediments strips oxygen from the bottom water at a rate faster than it can be mixed down from the surface layers. This results in severe oxygen depletion in the bottom water. The oxygen depletion problem is exacerbated by the presence of a high-salinity bottom layer which extends upstream about one-half mile from the new dam.[5] High-salinity water in the harbor intermittently flows into the Basin through the navigational locks at the New Charles River Dam. This saltwater is denser than the freshwater in the river and forms a stable bottom layer which resists mixing with the less dense surface water.

A program has been undertaken by the Metropolitan District Commission to destratify the saline layer. Aeration compressors with air outlets on the bottom of the deepest portion of the river between the Massachusetts Avenue Bridge and the Longfellow Bridge, were installed in 1979 to promote mixing of fresh and saline waters. The aeration compressors are effective in destratifying the portion of the River between the Longfellow and the Massachusetts Avenue bridges. Anoxic conditions in the separate deep channel upstream of the Massachusetts Avenue Bridge have been effectively prevented through the destratification project. Another aeration system currently operational in the Charles River Basin is the fountain at Canal Park (Lechmere Canal). Minimal amounts of dissolved oxygen are added during the operation of the compressors, mostly due to increased surface velocity of water in the immediate vicinity of the aeration outlet pipe.

5/ Charles River Basin 1987, Part D: Water Quality Management Plan; DEP/DWPC (1988).

In addition to the depletion of dissolved oxygen, two other water quality problems have been noted by the Massachusetts DEP: the presence of heavy metals and persistent organic compounds in the sediment and the presence of pathogenic micro-organisms in the water column. These problems have resulted from both industrial wastewaters discharges and discharges from combined sewer overflows. Industrial wastewaters have been discharged to the Charles River either directly or indirectly through sewage treatment plants for the past century. A wide range of toxic substances has been introduced to the Basin over the years. Many toxic substances have an affinity to bind with suspended particles in the water column and are likely to be incorporated in the bottom muck throughout the Basin.

There are twenty-eight combined sewer overflow pipes which can potentially discharge a mixture of untreated sewage and stormwater to the Charles River Basin during periods of very intense rainfall. Fifteen of these overflows are located within approximately one mile of the project site (see Figure IV-K-2).[6] After overflows, the raw sewage causes elevated levels of coliform bacteria, nutrients, and suspended solids concentrations in the river.

The correction of combined sewer overflows has been identified by the Department of Environmental Protection (DEP) as an important step towards achieving water quality standards in many urban receiving waters. In general, the complete separation of the combined sewer systems, which are widespread in the City of Boston, has been deemed to be too expensive to be a practical solution. The Massachusetts Water Resources Authority (MWRA) is currently in the design phase of a system of deep rock storage tunnels which will have adequate capacity to store combined sewage from all but the largest rainstorms. On a site-by-site basis, the separation of combined sewer systems is a practical first step to reducing the amount of stormwater which is going into the combined system and exacerbating the overflow problem. The New Boston Garden Development will provide separate storm drains in order to remove stormwater flow from the combined sewer system. The lessening of stormwater flow to the combined sewer system is the major mitigation provided for water quality impacts of the project (see Probable Project Impacts).

1988 Water Quality Data

An extensive water quality sampling program which included stations near the mouth of the Charles River was performed for the MWRA in 1988 as a component of the facilities plan for the control of combined sewer overflows.[7] The Charles River and the Inner Harbor were sampled as part of a year-long program which included twenty-nine sampling locations and over 4,100 samples. An extensive statistical analysis of the data was generated. Two of the stations included in this program were in the immediate vicinity of the New Boston Garden; Station SS2 was just upstream of the New Charles River Dam; and Station W2 was in the Inner Harbor, just downstream of the dam (see Figure IV-K-2). Data for selected water quality parameters are presented in Tables IV-K-1 and IV-K-2.

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[6] Only twelve combined sewer overflows are shown in Figure IV-K-2; there are three additional overflows on the Cambridge side of the Charles River which are not shown.

[7] Combined Sewer Overflow Facilities Plan, Technical Memorandum 3-10: Monitoring Program Results and Analysis (July 15, 1989).

Based on these data, the water quality of the Charles River in the portion just upstream of the New Charles River Dam does not conform to the applicable Class B standards (see Technical Data appendix). The minimum dissolved oxygen was below the applicable standard, and the counts of coliform bacteria were up to a factor of 100 times greater than allowable limits, indicating contamination of the Basin by sewage. Levels of the heavy metals cadmium, mercury, and zinc were in excess of the chronic (long-term) concentration limits; maximum concentrations of chromium VI exceeded the acute (short-term) standard.

In 1990, the tidal portion of the Charles River downstream of the New Charles River Dam was reclassified by the DEP/DWPC from saltwater Class SC (secondary contact only) to saltwater Class SB (primary and secondary contact and shellfish harvesting with mandatory bacterial decontamination). The 1988 MWRA-sponsored sampling program, which included Station W2 in the tidal portion of the Charles River, indicated that the existing water quality violates the Class SB standards for minimum dissolved oxygen and for maximum coliform bacteria. The elevated bacteria counts are presumably due to sewage entering the Charles River and the Inner Harbor at combined sewer overflows. Levels of the heavy metals mercury and nickel exceeded the chronic concentration limits. The copper concentration generally exceeded the concentration limits of acute and chronic toxicity.

Marine Life

A warmwater fishery of recreational importance is present in the Charles River Basin. Fish species reported by the Massachusetts Division of Fisheries and Wildlife for the Basin include, in order of abundance: golden shiners, white perch, alewife, pumpkinseed, yellow perch, white sucker, white catfish, northern pike, chain pickerel, and brown bullhead. Some of these species are also likely to be found between the old and new dams.[8]

The fish ladder at the New Charles River Dam allows smelt, herring, and alewife to migrate seasonally into the Charles River. The Charles River contains one of the three or four largest alewife and river herring runs in the state.

Based on the measured low levels of dissolved oxygen in the bottom of the water column, pollution-tolerant sludge worms are believed to be the dominant bottom-dwellers. The bottom sediments are devoid of oxygen and consequently do not support any species of aquatic life which requires dissolved oxygen.

SITE DRAINAGE

Existing Conditions

The total drainage area of the site consists of 9.89 acres. Only 2.04 acres of the site is currently owned by New Boston Garden Corporation. The remainder of the site is owned and maintained by the MBTA (3.69 acres), MDPW (3.5 acres), and the City (0.66 acres). At present, New Boston Garden Corporation is only responsible for site drainage from the existing Boston Garden.

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[8] Draft Supplemental EIR/EIS for the Central Artery/Tunnel Project.

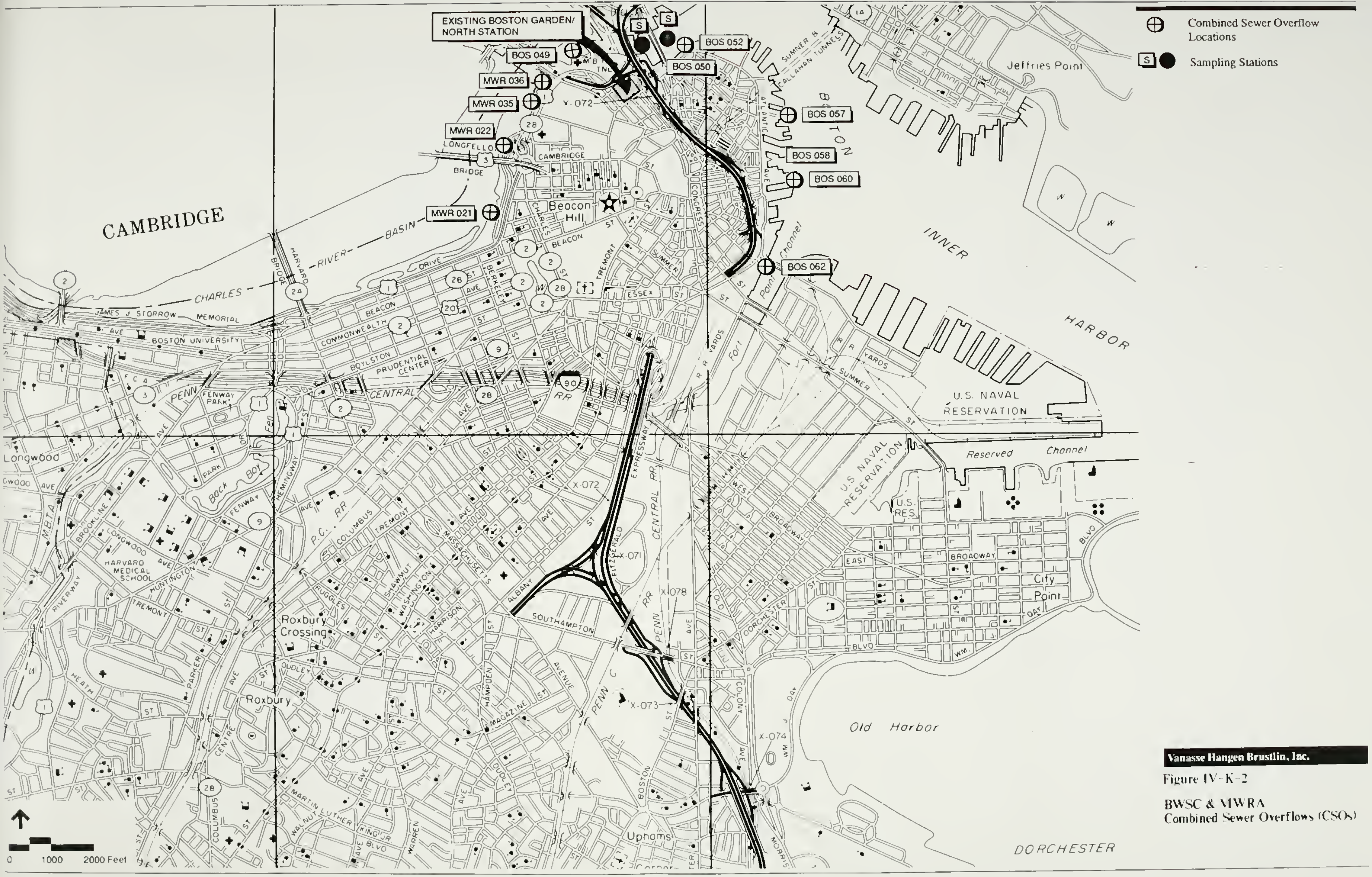

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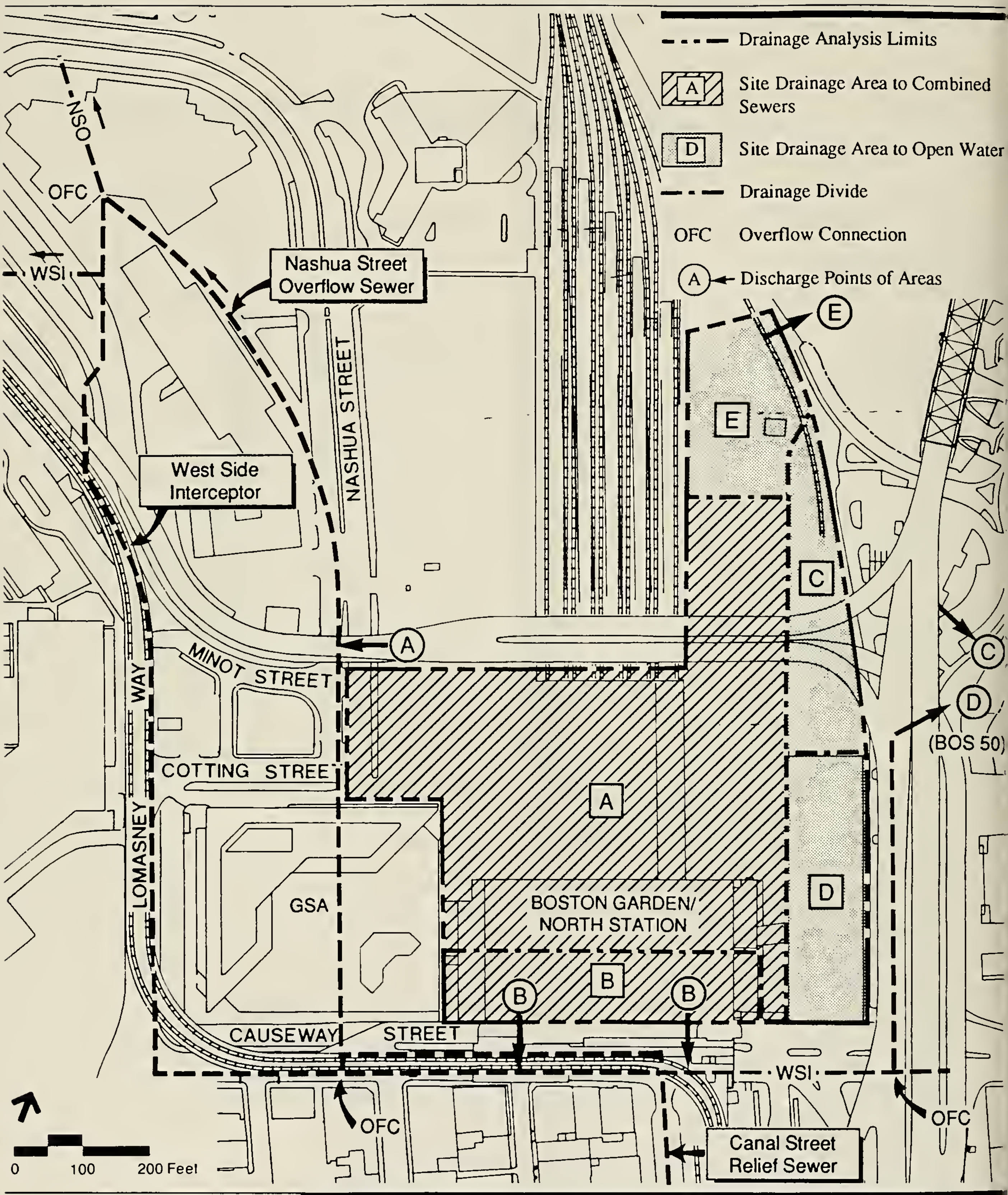
Figure IV-K-2

BWSC & MWRA
Combined Sewer Overflows (CSOs)

Table IV-K-1 **1988 WATER QUALITY DATA FOR STATION SS2 IN THE CHARLES RIVER NEAR CHARLES RIVER DAM (ABOVE DAM)***

Parameter	Mean	Minimum	Maximum	Surface Water Quality Standard**
Dissolved Oxygen (mg/l)	5.8	3.6	8.7	5.0
Oil & Grease (mg/l)	5	5	5	No surface sheen
pH	7.1	6.7	7.6	6.5-8.3
Salinity (ppm CL)	354	110	740	N/A
Total Coliform***	16,900	1,000	110,000	1,000^
Fecal Coliform***	1,428	100	14,200	200^^
Suspended Solids (mg/l)	9	5	22	Not to impair assigned uses
Ammonia-N (mg/l)	0.6	0.4	0.7	1.7^^^
Nitrate (mg/l)	10.2	0.4	37.0	Not to promote eutrophication
TKN (mg/l)	1.0	1.0	1.1	Not to promote eutrophication
Ortho-P (mg/l)	0.2	0.1	0.3	Not to promote eutrophication
Arsenic (ug/L)	14.1	1.5	50.0	CC: 48 AC: 850+
Cadmium (ug/L)++	2.9	1.6	4.3	CC: 11 AC: 3.9
Chromium VI (ug/L)	8.8	5.0	20.0	CC: 11 AC: 16
Copper+++ (ug/L)	10.4	5.8	14.2	CC: 12 AC: 18
Mercury (ug/L)	0.5	0.2	0.9	CC: 0.012 AC: 2.4
Nickel (ug/L)ı	12.0	9.4	15.7	CC: 96 AC: 1,800
Zinc (ug/L)	55.7	21.1	94.4	CC: 47 AC: 320

Notes: (ug/L) = micrograms per liter; (mg/l) = milligrams per liter
Violations of standards are underlined.
* Station SS2; 13 to 15 samples for the parameters dissolved oxygen through suspended solids, 2 to 4 samples for metals and nutrients.
** See Commonwealth of Massachusetts Water Quality Standards for Class B waters (WQS).
*** Numbers of organisms per 100 milliliter of sample, mean is the log mean of fifteen samples.
^ Bathing beach standard (MWRA).
^^ Class B Standard; Class C Standard is 1000, See Commonwealth of Massachusetts (WQS) in Technical Data appendix.
^^^ Temperature and pH dependent standard; listed value is for pH = 7.00, T = 20 C. Taken from "Quality Criteria for Water 1986" (see following note).
+ CC: Chronic Criteria; AC: Acute Criteria; from "Quality Criteria for Water 1986" available from the USEPA. Chronic criteria were used to determine violations of mean pollutant concentration. Acute criteria were used to determine violations of maximum pollutant concentrations.
++ Toxicity of Cadmium is hardness-dependent (100 mg/l hardness used).
+++ Toxicity of Copper is hardness-dependent (100 mg/l hardness used).
ı Toxicity of Nickel is hardness-dependent (100 mg/l hardness used).


Drainage Analysis Limits
A Site Drainage Area to Combined Sewers
D Site Drainage Area to Open Water
Drainage Divide
OFC Overflow Connection
A Discharge Points of Areas
OSN
OFC
WSI
Nashua Street Overflow Sewer
NASHUA STREET
West Side Interceptor
LOMASNEY WAY
MINOT STREET
COTTING STREET
CAUSEWAY STREET
GSA
BOSTON GARDEN/ NORTH STATION
A
B
C
D
E
(BOS 50)
WSI
OFC
OFC
Canal Street Relief Sewer
0
100
200 Feet
Vanasse Hangen Brustlin, Inc.

Existing
Site Drainage Areas

Figure IV-K-3

Table IV-K-2 **WATER QUALITY DATA FOR STATION W2 IN THE CHARLES RIVER NEAR CHARLES RIVER DAM (BELOW DAM)***

Parameter	Mean	Minimum	Maximum	Surface Water Quality Standard**
Dissolved Oxygen (mg/*l*)	5.3	3.7	7.5	5.0
Oil & Grease (mg/*l*)	5	5	5	No surface sheen***
pH	7.4	6.9	7.8	6.5-8.5
Salinity (ppm CL)	6,478	405	12,500	N/A
Total Coliform^	10,000	300	740,000	N/A
Fecal Coliform^	807	60	19,000	200
Suspended Solids (mg/*l*)	35	7	122	Not to impair assigned uses
Ammonia-N (mg/*l*)	1.1	0.6	2.6	N/A
Nitrate (mg/*l*)	0.6	0.1	2.5	Not to promote eutrophication
TKN (mg/*l*)	0.8	0.6	1.1	Not to promote eutrophication
Ortho-P (mg/*l*)	0.1	0.1	0.2	Not to promote eutrophication
Arsenic (ug/L)	50.0	50.0	50.0	CC: 36 AC: 69^^
Cadmium (ug/L)	4.0	1.5	6.8	CC: 9.3 AC: 43
Chromium VI (ug/L)	8.0	5.0	20.0	CC: 50 AC: 1,100
Copper (ug/L)	5.6	2.5	9.4	CC: 2.9 AC: 2.9
Mercury (ug/L)	0.5	0.3	0.7	CC: 0.025 AC: 2.1
Nickel (ug/L)	11.4	9.4	15.7	CC: 7.1 AC: 140
Zinc (ug/L)	28.0	18.2	37.0	CC: 58 AC: 170

Notes: (ug/L) = micrograms per liter; (mg/*l*) milligrams per liter
Violations of standards are underlined.

* Station W2; 19 samples for the parameters dissolved oxygen through susp. solids, 1-5 samples for metals and nutrients.

** Class SB Waters.

*** See Commonwealth of Massachusetts Water Quality Standards (WQS) (see Technical Data appendix).

^ Numbers of organisms per 100 milliliter of sample, mean is the log mean of 19 samples.

^^ CC: Chronic Criteria, AC: Acute Criteria; from "Quality Criteria for Water: EPA-440/9-76-023," as subject to periodic updates. Chronic criteria were used to determine violations of mean pollutant concentration. Acute criteria were used to determine violations of maximum pollutant concentrations. Listed values for arsenic are for the trivalent form (most toxic form). Measured values were not distinguished as to the valency.

The major portion of the project site, shown as drainage area A in Figure IV-K-3 (6.31 out of 9.89 acres), currently drains to the Nashua Street Overflow (NSO) (also known as BOS 49). The NSO is a combined sewer system (further specifics on the NSO are given in the Chapter IV-J, Infrastructure). BOS 49 has a high weir which is set at an elevation of +9 NVGD. The weir prevents all but extreme storm combined flows from overflowing into the Charles River. During dry weather, sanitary sewage is conveyed by the NSO to the Deer Island Sewage Treatment Plant by means of the Charles River Estuary Pollution Control Facility (CREPCF). This station is located on the northern bank of the Charles

River, at the Cambridge/ Charlestown boundary. The CREPCF was brought on line in 1980 to reduce the frequency and volume of untreated overflows of combined sewage into the Charles River. The dry weather sanitary sewage flow at the CREPCF is generally two to three million gallons per day (mgd). Wet weather flow is treated at the CREPCF and then discharged to the Boston Harbor. Further specifics on the CREPCF are given in Chapter IV-J, Infrastructure.

The CREPCF can provide treatment for combined sewage flows of up to 323 mgd, the equivalent of the runoff produced from a storm with a recurrence frequency of five years. In a storm of greater intensity than the five-year storm, some portion of the combined sewage will bypass the CREPCF and be directly discharged (untreated) to the Charles River.

The CREPCF facility has a storage capacity for treated combined sewage of 1.2 million gallons; only when the storage capacity is exceeded does an overflow occur to the Charles River. Based on the facilities plan for the CREPCF, overflows of treated combined sewage to the Charles River are expected to occur on an average of fifty-five times per year. The treated combined sewage from the CREPCF enters the Charles River at an outfall pipe just downstream of the New Charles River Dam.

As discussed in Chapter IV-J, Infrastructure, drainage area B, which is 0.96 acres in extent, currently drains to the West Side Interceptor (combined sewer). Drainage areas C, D and E drain to separated stormwater sewers which discharge to the Charles River at locations just upstream and just downstream of the New Charles River Dam. The drainage to these latter separated storm drains comprises approximately 1.68 acres of pavement and 0.94 acres of roof-top. These separated storm drains are not subject to contamination by sanitary sewage. The rooftop drainage enters a storm drain which terminates in a 36-inch pipe discharging near the waterfront terminus of Beverly Street. This pipe discharges to the Charles River in the tidally influenced waters on the harbor side of the New Charles River Dam. This discharge is referenced in the National Pollutant Discharge Elimination System (NPDES) permit as BOS 50, which is owned by the MWRA. Formerly, this discharge location was subject to surcharging overflows from the West Side Interceptor combined sewer. The overflow connection to the Beverly Street drain has been temporarily closed.

Areas of rooftops and paved areas draining to combined sewers or to the Charles River by way of separated storm sewers are summarized in Table IV-K-3 below.

Stormwater Contaminants

Sources of pollutants in urban stormwater discharged through separated storm drains include airborne dust and transportation-related contaminants such as oils and gasoline. These contaminants accumulate on impervious surfaces during dry weather and are rapidly washed off into drainage catchments during rainstorms. Once deposited, up to 90 percent of the atmospheric pollutants deposited on impervious surfaces are delivered to receiving waters.

Table IV-K-3 **DRAINAGE SUMMARY - EXISTING CONDITIONS**

Combined Sewer (CS) or Storm Drain (SD)	Drainage Area*	Roof Area (Acres)	Pavement Area (Acres)	Total (Acres)
Canal Street Relief Sewer (CS)	A	1.02	5.10	6.31**
West Side Interceptor (CS)	B	0.90	0.06	0.96
Charles River above dam (SD)	E	----	0.84	0.84
Charles River below dam (SD)	C,D	0.94	0.84	1.97
TOTAL		2.86	6.84	9.89

* Refer to descriptions of drainage areas in the Infrastructure section.
** Includes 0.19 acre of railroad tracks.

Additional pollutants associated with transportation uses of the commercial component garage and other paved areas at the project site include lead from gasoline and other trace metals from metal plating, catalytic converters, brake linings, and tires. Over time, these surfaces corrode, flake, or leach out, enabling the metals to wash away in urban runoff. Transportation uses are also associated with emissions of petroleum products, generally categorized as oils and greases, which accumulate on heavily used roadways and parking areas. Petroleum residues dissolved in vehicular drippings within the project Garage of the commercial component will be removed in an oil/water separator before this water is discharged to the BWSC sanitary sewer system (see Mitigation Measures). Other sources of pollutants that accumulate and subsequently wash off impervious surfaces include animal fecal matter, vegetative matter, litter, and debris.

The greatest amounts of atmospheric contaminants deposited in urban areas include total solids and reduced organic and inorganic substances. These reduced substances can consume dissolved oxygen in receiving waters, thereby resulting in a deficiency of dissolved oxygen. Trace metals in urban runoff can kill or injure aquatic organisms in the receiving waters when critical metal concentrations are exceeded for significant periods of time. Because the overall imperviousness of the site is, at present, effectively 100 percent, with no change expected following the completion of the project, atmospheric deposition rates estimated for the project site under Existing conditions are not expected to be significantly different following the completion of the New Boston Garden Development. Average annual atmospheric deposition rates estimated for typical urban areas are presented in Table IV-K-4. The quantities reported under the column "site export load" are equal to the product of the reported "deposition rate per acre" times the site area of 9.89 acres.

Table IV-K-4 ESTIMATED ATMOSPHERIC DEPOSITION RATES*

Pollutant	Typical Urban Area Deposition Rate (pounds per acre per year)	Site Export Load** (pounds per year)
Total Solids	245	2,422
Chemical Oxygen Demand	210	2,077
Total Nitrogen	17.0	167
Nitrate - N	6.8	67
Ammonia - N	1.0	10
Total Kjeldahl - N	10.2	100
Total Phosphorus	0.84	8.3
Ortho phosphorus	0.35	3.4
Trace Metals		
Cadmium	0.003	0.03
Copper	0.61	6.0
Lead	0.53	5.3
Iron	5.60	55.3
Zinc	0.65	6.4

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* Based on typical Atmospheric Deposition Rates.

** Export load is estimated based on an area of 9.89 acres for the project site. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs; Metropolitan Washington Council of Governments (July 1987).

The stormwater effects associated with the construction of the New Boston Garden will not include suspended soil particles since the project is an air rights development. The New Boston Garden is being constructed upon a foundation system being built by the MBTA as part of its underground garage. The impacts of the MBTA garage excavation were considered in the MEPA review of that project (EOEA #7433) and are not part of the present analysis. The potential for suspended sediments in drainage from the construction site for the commercial component of the development are addressed later in this section. After the development of the project site is complete, the primary source of suspended and dissolved solids in stormwater runoff is from the atmosphere in the form of wet and dry deposition, which will be washed off roof surfaces through roof drains. Standard sedimentation controls should prevent any significant discharge of pollutants through the project Garage underdrains.

PROBABLE PROJECT IMPACTS

The impact analysis conditions to be addressed include the following three conditions: 1990 Existing conditions, 2000 No-Build and 2000 Full-Build. The Existing conditions have previously been presented; this section evaluates the impacts under 2000 No-Build and 2000 Full-Build conditions.

2000 No-Build Conditions

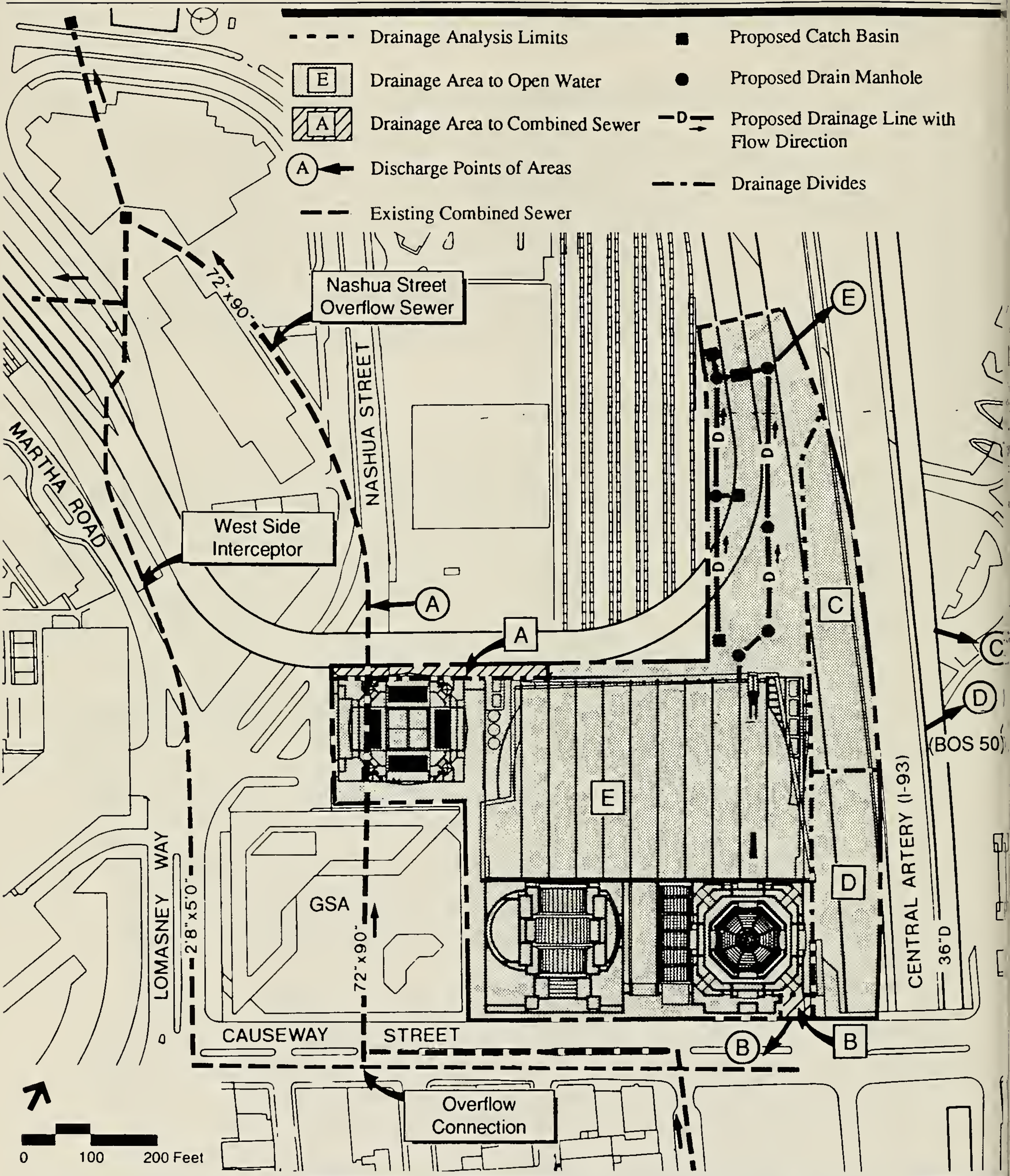
The storm drainage pattern from the project site will be similar to Existing conditions with the exception that the drainage from the demolished 150 Causeway Street (Anelex Building) will be from grade level (until the construction of the ramps for the depressed Central Artery at this location). The MBTA underground garage will be constructed and the drainage will be the responsibility of the MBTA. The exact drainage configuration from this condition has yet to be determined. The existing arena drainage would remain the same as current conditions. The quality of stormwater from the site under the 2000 No-Build condition should be similar to that of Existing conditions because the percentage imperviousness of the site will be effectively 100 percent.

2000 Full-Build Conditions

The storm drainage system which will be constructed as a component of the site preparation for the New Boston Garden is described in Chapter IV-J, Infrastructure. Under the Full-Build condition, virtually all project surfaces which formerly drained to the Nashua Street Overflow (NSO) or to the West Side Interceptor (WSI) will be rerouted to the proposed separate storm drain which will discharge to the Charles River just upstream of the New Charles River Dam. As shown in Table IV-K-5, the majority of site drainage will be from rooftops as opposed to paved at-grade surfaces (see Figure IV-K-4). Unlike the drainage from paved at-grade areas, the rooftop drainage is not expected to contain petroleum hydrocarbons. The drainage from vehicular drippings within the project Garage below the commercial component will be directed to an oil/water separator before it is released to the BWSC sanitary sewer system. The separator will be designed and sized according to the applicable regulations established by the MWRA for discharges to the sanitary sewer.

The commercial component garage is below the level of the groundwater table and requires the use of underdrains to prevent the buildup of hydrostatic pressures on the bottom floor of the garage (further discussion is provided in the Geotechnical Conditions section). The pumped water (200 to 300 gpm) will be routed to a sedimentation chamber before it is released to the Charles River upstream of the dam. The sedimentation chamber will be sized properly to allow the discharged water to meet NPDES criteria for suspended sediments in discharges to surface waters.

Because of the construction of a separate storm drain system in place of the combined sewer system currently receiving site runoff, the portion of the project site which drains directly to the Charles River upstream of the dam will increase from 0.84 acres to 8.15 acres. The small portion of the project site, which under current conditions is drained by means of separate storm drains to the Charles River just below the dam, will decrease slightly under Full-Build conditions from 1.78 acres to 1.57 acres. The resulting increase in the wet weather flows of the Charles River should be negligible, since the increase in the Charles River drainage area amounts to only 0.004 percent of the total basin drainage area. Corresponding to the increase in the areas on the site which will drain to the Charles River, there will be a decrease in project areas which drain



Future Site
Drainage Areas

Figure IV-K-4

Table IV-K-5 **SITE DRAINAGE FOR FULL-BUILD CONDITIONS**

Combined Sewer (CS) or Storm Drain (SD)	Drainage Area Designation*	Roof Area (Acres)	Pavement Area (Acres)	Total (Acres)
Nashua Street Overflow (CS)	A	--	0.14	0.14
West Side Interceptor (CS)	B	--	0.03	0.03
Charles River Upstream of Dam (SD)	E	6.41	1.74**	8.15
Charles River Downstream of Dam (SD)	C&D	--	1.57	1.57
TOTAL		6.41	3.48	9.89

Note: CS=combined sewer; SD=Storm drain.
* Refer to descriptions of drainage areas in the Infrastructure section.
** Includes 1.57 acres of pavement/truck dock area.

to combined sewers. The areas which drain to a combined sewer system will decrease from 7.27 acres under Existing conditions to 0.17 acres under Full-Build conditions. This virtual elimination of project areas which drain to combined sewers will result in a nearly complete elimination of stormwater inflow from the project site to Boston's combined sewer system. The reduction in stormwater inflow will reduce the frequency of wet weather surcharging of the combined sewer system and the volume of the consequent treated overflows to the Charles River. This reduction of stormwater inflow to combined sewer systems is fully consistent with the DEP's policy for the abatement of pollution from combined sewer overflows.[9]

The overall benefit of the New Boston Garden and the commercial component on the water quality of the Charles River and the Inner Harbor can be measured against the current frequency and volume of overflows from the combined sewer system. At the present time and until the completion of the deep rock stormwater storage tunnel project discussed earlier, the combined sewer system within the Boston metropolitan area will have inadequate capacity to convey all flows generated during wet weather to the Deer Island Sewage Treatment Plant. The design capacities for average daily flow and maximum flow to the Deer Island Treatment Plant are 343 mgd and 848 mgd, respectively. Potential flows of combined sewage within the collection system during wet weather far exceed the treatment and pumping capacity of the Deer Island facility, resulting in discharges from combined sewer overflow pipes.

Under Existing conditions at the project site, both stormwater and sanitary sewage enter the combined sewer from the project site. As mandated by the MWRA, the design storm for the analysis of total flows to the combined sewer system is a one-year recurrence, six-hour duration event.[10]

9/ Massachusetts Water Quality Standards: Implementation Policy for the Abatement of Pollution from Combined Sewer Overflows (February 13, 1990).

10/ Standards for Inflow/Infiltration Analysis; Massachusetts DEP, Division of Water Pollution Control.

Storm flows to the combined sewer system from the one-year, six-hour design storm are projected to decrease substantially as a result of the rerouting of stormwater to a separate storm drain system. As indicated in Table IV-K-6, stormwater flows to the combined sewer system will decrease from 3.68 mgd to 0.08 mgd, (daily flow figure based on the design storm; see Chapter IV-J, Infrastructure).

Table IV-K-6 **STORM RUNOFF TO COMBINED SEWER SYSTEMS**

Analysis Conditions	Drainage Area (acres)	Flow (mgd)
Existing Conditions	7.27	3.68
New Boston Garden (Arena Only)	3.37	1.71
New Boston Garden Development	0.17	0.08

Because of the large decrease in stormwater flows to the combined sewer system, the sum of the total flow of stormwater and sanitary sewage flows also decreases substantially (see Table IV-K-7).

Table IV-K-7 **COMBINED STORM AND SANITARY FLOWS TO COMBINED SEWER SYSTEMS**

Analysis Conditions	Stormwater Flow (mgd)	Sanitary Sewage Flow (mgd)	Total Flow (mgd)
Existing Conditions	3.68	0.101	3.78
New Boston Garden (Arena Only)	1.71	0.095	1.81
Total New Boston Garden Development	0.08	0.267	0.35

Because of the plans to better manage stormwater runoff within the new development, the total combined flow for the design storm plus the sanitary flow will decrease from 3.78 mgd under Existing conditions to 1.81 mgd after completion of the New Boston Garden. Under Full-Build conditions, the combined storm and sanitary flow is projected to be 0.35 mgd, which is less than 10 percent of the flow under Existing conditions. The lowered total flows to Boston's combined sewer system will lessen the frequency of surcharging and resultant release of treated combined sewage from overflows. The reduction in frequency and volume of combined sewer overflows will result in less frequent violations of designated water quality classification standards for the Charles River in the vicinity of the New Charles River Dam.

Total volumes of stormwater flow to the Charles River during a ten-year recurrence storm event are presented in the Drainage section. The fraction of the total flow in the Charles River during a ten-year storm which originates from the project site, is on the same order of magnitude as the percentage of the total basin area constituted by the project area, approximately 0.004 percent.

The stormwater from the project site is likely to be less loaded with petroleum hydrocarbons than average storm drainage in the Charles River Basin catchment since the majority of the drainage will be from rooftop surfaces rather than from parking or roadway areas. As discussed in Chapter IV-J, Infrastructure, a 2-acre subdrainage of the site will receive drainage from a vehicle turnaround area. Drainage from this area will be treated by an an oil/water separator. This separator is proposed in order to mitigate the impacts of oil and gas residues present in stormwater discharged to the Charles River. The effectiveness of this mitigation method is discussed in the Mitigation Measures section below.

CONSTRUCTION IMPACTS

The excavation of the six-level project Garage below Building B, Building C, and the Public Concourse will require dewatering of soils below the water table. The soil profile for the garage area, in sequence from the ground surface down, consists of miscellaneous fill, organic silt and sand, intermittent strata of sand and gravel, silty clay, and bedrock (see Chapter IV-M, Geotechnical Conditions). The level of groundwater generally ranges between 7 and 11 feet below existing grade. The presence of regulated contaminants (oil or hazardous materials) in the soils and groundwater beneath the New Boston Garden Development garage site has not yet been evaluated. However, no special pretreatment for chemical contaminants was found to be necessary during construction dewatering operations for the MBTA garage, immediately adjacent to the site.[11]

An independent site investigation will be performed for the New Boston Garden Development garage site by a geotechnical engineer. This investigation will evaluate whether there will be any need to pretreat the dewatering effluent to remove chemical contaminants. Standard sedimentation controls will be used. The use of slurry walls as a groundwater cutoff will limit the amount of seepage into the excavation. Also, construction on the ground floor slab prior to excavation will essentially eliminate water from collecting in the excavation due to precipitation. Thus, the need for construction dewatering will be limited, which will minimize water quality impacts associated with the disposal of pumped groundwater. Other mitigation measures associated with the construction of the project Garage are addressed in Chapter IV-M, Geotechnical Conditions.

Except for the initial site preparation, all excavated soil will be placed directly in covered gravel-hauling trucks to be transported to approved disposal sites after each truck is filled. There will be no stockpiling of materials on the site. All demolition debris from the removal of the existing Boston Garden will likewise be transported off-site on a continual basis to minimize the potential for adverse impacts on stormwater by construction debris.

11/ Environmental Site Assessment, MBTA North Station Transportation Improvement Project North Station Garage Site, Boston, Massachusetts; performed by G.E.I. Consultants, Winchester, MA (August 15, 1989).

MITIGATION MEASURES

The most significant measure to minimize adverse water quality impacts of the project and to improve the existing water quality of the Charles River, is the reduction of inflow to combined sewers and the consequent reduction of the frequency and volume of combined sewer overflows in the project area.

The total drainage area of the site is 9.89 acres, 2.04 acres of which is currently owned by New Boston Garden Corporation, 3.5 acres which is currently owned and operated by the MDPW, and 3.69 acres owned and operated by the MBTA and the City (0.66 acres). The proposed New Boston Garden Development will provide for the construction and future maintenance of the drainage for the entire site, including the MBTA and the MDPW portions. This should be viewed as a public benefit, since these agencies will no longer be responsible for the cost of constructing and maintaining the site drainage system.

The storm drainage from the paved portion of the project site which, after the completion of the New Boston Garden Arena, will serve as a vehicle turn around, could potentially receive loadings of petroleum residues from the bus operations. In order to mitigate the impact of these residues on the Charles River, an oil/water separator is proposed to remove light volatile hydrocarbons from the 2-acre drainage area associated with the bus concourse. The separator will be designed according to MDC standards and will be sized to detain for a 5-minute period the peak flow of a storm characterized by a one-hour rainfall intensity which has a probability of occurring at least once in every five years. Floatable hydrocarbons will be trapped above the opening of an inverted elbow and will potentially evaporate to the atmosphere after the end of the rainstorm. The oil/water separator will be constructed at the end of the storm drain from the vehicle turnaround area, before the point of discharge to the Charles River. Storm drains and catchbasins will be maintained by the proponent.

The catchbasins to be installed as part of the drainage system for the project will conform to MDC standards and will include sump areas to collect heavier sediments with absorbed oil and other contaminants. The maintenance of the catchbasins and the oil/water separator will include regular inspection and cleanouts when needed to ensure proper trapping capacity. One of the maintenance options being considered by the project proponent is the use of oil-absorbent "mops" (commercially available for oil spill control) to enhance the performance of the oil/water separator.

In summary, the minimization of stormwater inflow to the combined sewer system and the removal of petroleum residues in stormwater released to the Charles River will provide effective mitigation to the water quality impacts associated with the project.

L Solid and Hazardous Waste

INTRODUCTION

This section addresses issues associated with the generation and disposal of solid and hazardous wastes from the project during demolition of the existing Boston Garden and construction and operation of the New Boston Garden Development. Hazardous wastes which will require special handling during transport and disposal, consist of materials that exceed criteria for certain contaminants as established by the US Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (DEP). Solid wastes constitute all other material being disposed in connection with demolition, excavation, construction, and operation of the project.

Waste handling and disposal requirements are clearly defined for certain materials, such as PCBs within transformers. Other waste materials generated during construction, such as oil-contaminated soils, will be handled as contaminated waste. While it is unlikely that most of these soils will meet or exceed criteria for hazardous wastes, it is also likely that they will not be classifiable as "clean fill" and will have to be disposed of according to Massachusetts DEP guidelines. As part of a preliminary site evaluation, the project proponent has initiated a soil sampling and analysis program to evaluate the fill materials to be removed as part of construction. The presence of potential contaminants will be assessed. Once the project is complete, solid waste will be generated by the New Boston Garden and the office and retail uses. Solid wastes associated with the operation of the New Boston Garden and the commercial component of the New Boston Garden Development will include paper, food service wastes, and office waste. No hazardous wastes are expected to be generated during construction or operation of the project.

EXISTING CONDITIONS

The proposed development is located in the North Station area, an urbanized area of Boston. The site is bounded by Causeway Street to the south, the General Services Administration building and Nashua Street to the west, the John Fitzgerald Expressway viaduct ramps to the north, and the existing MBTA Orange Line subway and Anelex Building (150 Causeway Street) to the east. At the north end of the site, the MBTA is currently constructing an underground parking garage which will serve as the foundation for the proposed New Boston Garden and portions of Building A.

As described in Chapter IV-E, the project site has supported a variety of commercial businesses dating back to the 1800s, including railroad activities, warehouses, and coal and lumber facilities. The existing Boston Garden, which opened in 1929, currently occupies the portion of the site where the underground project Garage for the commercial component of the project will be constructed. Boston Garden contains various mechanical systems that utilize petroleum products or other standard materials which may be classified as hazardous. The demolition of the existing building and the excavation for the proposed underground project Garage will result in the need to dispose of several categories of hazardous and solid wastes. The major categories of materials requiring disposal are described below.

Debris from Demolition of the Boston Garden/North Station Building

The bulk of debris will consist of masonry, wood, structural steel, pipe, and other standard construction materials. Given the age of the building, it is likely that paint on the various materials may contain lead. In addition, a variety of asbestos-containing materials have been identified within the building. A pre-demolition asbestos survey has been initiated by the proponent to determine the location of asbestos materials for the purpose of developing an asbestos abatement program.

Fuel Storage Tanks

The existing Boston Garden is heated using No. 6 fuel oil stored in an above-ground 10,200-gallon storage tank located behind the boiler room. Based on available records, it appears that there were no underground storage tanks serving the building since the facility originally used steam power provided by Boston & Maine Railroad.

Refrigeration Systems

The existing Boston Garden does not have an air conditioning system, but there is a large refrigeration system used to form ice on the ice rink. The primary cooling loop uses a freon-based product. Antifreeze is used in the secondary cooling loop. There is also stand-alone refrigeration equipment associated with concession stands and restaurants throughout the building.

Hydraulic Fluids

In the weight room area, there is an old elevator that reportedly operates using a hydraulic cylinder which uses hydraulic fluids.

Transformers

Electrical transformers at the existing Boston Garden have been replaced several times over the life of the building. At present, there are large abandoned transformers in the refrigeration room area and smaller transformers in other locations. The older transformers may contain PCB-based dielectric fluid. New transformers serving the New Boston Garden Development will not contain PCBs.

Excavated Soil

Construction of the project Garage below Buildings B, C and the Public Concourse will involve the excavation and removal of up to 65 feet of soil, including 20 to 25 feet of material placed as fill. Given the history of the site as a transportation terminal, residual petroleum hydrocarbons and combustion products from coal-fired steam engines are anticipated to be present in varying concentrations in the soil, particularly in the top of the fill. Studies to evaluate potential contamination in these soils are currently being conducted by the proponent's geotechnical engineer. Only minor excavation for caissons is required for Building A and the New Boston Garden, since these buildings will, for the most part, use the MBTA Garage as a foundation.

Solid Waste from Current Operations

The solid waste generated by the existing Boston Garden includes waste from the arena as well as waste from the offices and restaurants within the building. The waste typically consists of paper products, food service wastes, and some office wastes. According to the New Boston Garden Corporation, the amount of waste generated varies throughout the year depending on activities and events in the Boston Garden. During the fall, winter, and spring months, a period of about eight months, 60 cubic yards (2 tons) is generated per week. During the remaining summer months, approximately 30 cubic yards are generated per week. The summer waste generation is less since the arena does not operate as frequently during the summer. The total annual waste output of the Boston Garden is approximately 96 tons per year.

Currently, trash is collected in a 30 cubic yard dumpster located in the Exhibit Hall area on the second floor of 150 Causeway Street. Trash removal and disposal is handled by an independent licensed contractor. Trucks enter 150 Causeway Street via the ramp located at the rear of the building. Trash is removed on an as-needed basis and is disposed of at an appropriate landfill. No hazardous wastes are generated as a result of existing operations.

PROBABLE PROJECT IMPACTS AND MITIGATION MEASURES

Demolition and Excavation

The New Boston Garden Development will involve the demolition of the existing Boston Garden comprising approximately 41,000 cubic yards of building debris, and the excavation and removal of approximately 215,000 cubic yards of soil for construction of the six-level underground project Garage beneath Buildings B and C and the Public Concourse. The demolition of the existing structure will be through the use of cranes, and possibly wrecking balls and front-end loaders. The use of explosives is not anticipated. Demolition of the Boston Garden and excavation of fill which was placed during the prior century and which is from an area used for railroad operations, will require procedures to manage the removal and disposal of potentially contaminated materials. Throughout the demolition and construction process, provisions will be made to separate hazardous wastes from demolition debris and from excavated urban fill. Efforts to identify the presence of potential hazardous materials in the existing building and soils beneath the building are already underway.

Demolition Debris

Chapter 54 of Chapter 40 of the Massachusetts General Law requires that debris resulting from the demolition of an existing structure must be disposed of at an appropriately licensed solid waste disposal facility. In addition, the proponent must notify the City of Boston and the Department of Environmental Protection (DEP) of the location to which the debris will be transported for disposal. Given that no contractor has yet been selected to undertake the demolition of the existing Boston Garden, no decision has been reached as to which licensed facility the debris will be taken.

It is currently anticipated that the demolition of Boston Garden will generate approximately 41,000 cubic yards of debris, the bulk of which will be masonry, wood, structural steel, pipe, and other wastes. Masonry may be disposed of in sanitary landfills provided that it is broken up to meet DEP solid waste requirements. Wood, pipe, and structural steel cannot be disposed of in sanitary landfills and will be disposed of at appropriate solid waste or recycling facilities. Demolition debris will be recycled to the fullest extent possible. As described below, asbestos or other hazardous materials that may be present in the structures will be identified, removed, and disposed of in accordance with all applicable requirements prior to initiation of general demolition activity.

As the project progresses toward construction, the proponent will consult with the City of Boston and the DEP concerning suitable locations for disposal of demolition debris. A licensed landfill will be identified as part of the negotiations with the selected demolition contractor, and proper notification will be provided to the appropriate agencies.

Asbestos

Asbestos-containing materials have been identified within the existing Boston Garden. An asbestos abatement program will be undertaken by a certified asbestos handling contractor prior to initiating general demolition of the building. It is likely that the asbestos removal program will occur during the summer of 1991 when use of the building for events is minimal. The asbestos removal program will be conducted in accordance with the applicable regulations of the Massachusetts Department of Labor and Industries, Massachusetts Department of Environmental Protection; the US Environmental Protection Agency; and the US Occupational Safety and Health Administration.

Transformers

At present, there are twenty-two transformers in the building, including several large transformers in the refrigeration room area and smaller transformers at other locations in the existing Boston Garden. As the existing Boston Garden is decommissioned, an inventory of all transformers (both active and inactive) will be prepared and all nameplate data will be collected. Where necessary and feasible, the manufacturers of each transformer will be contacted based on with the serial number data, and a determination will be made regarding the probable presence of PCB-based dielectric fluid. Where there is no nameplate or if the manufacturer is no longer in operation, a sample of the fluid in the transformer will be collected for PCB analysis. All transformers identified as containing PCBs will be disposed of in accordance with applicable regulations governing PCBs. Non-PCB transformers will be disposed of through scrap metal or other suitable recycling companies in accordance with applicable requirements.

Refrigeration Systems

For the existing arena, the primary refrigeration system used to create the ice for the ice rink contains a freon-based product. This product will be removed from the system by a qualified refrigeration contractor and will be handled in accordance with applicable hazardous waste requirements. The secondary cooling loop contains antifreeze which will also be removed from the piping system and handled as a separate waste prior to demolition of the ice rink floor. Antifreeze is not a listed hazardous waste but it will be disposed of only through specialty recycling contractors who collect the antifreeze for processing and reuse. The refrigeration system will be serviced and decommissioned by a qualified contractor specializing in the maintenance and repair of refrigeration systems. The coolant systems at the concession stands and in the first floor restaurants will be removed before demolition begins.

Hydraulic Fluids

The hydraulic fluid in the cylinder, pump, and reservoir of the elevator in the weight room area in the existing arena will be drained and removed from the site, in accordance with applicable requirements, prior to general demolition of the equipment. This procedure will also be followed for any other equipment containing hydraulic fluids which are encountered during demolition. Used hydraulic oil must be handled in accordance with 310 CMR Section 3.00.

Excavated Soils

Preliminary estimates indicate that approximately 215,000 cubic yards of soils will be excavated and disposed of during construction of the project Garage below Buildings B and C and the Public Concourse. Approximately 40 percent of the excavated soil will consist of material previously placed as fill. This material will be disposed of in accordance with applicable requirements at a site selected on the basis of information generated by the proponent's geotechnical consultant.

As part of the geotechnical evaluation of the project site, soil samples will be collected for analysis to determine soil quality. Excavated soil will be segregated based upon chemical characteristics. Soils that contain oils or other hazardous materials will be disposed of in accordance with applicable DEP regulations. In addition, excavated wood and other material that may not be acceptable in sanitary waste landfills will be segregated and disposed of in an appropriate landfill.

The most probable contaminant most likely to be encountered in the site soils is oil. DEP regulates virgin petroleum oil-contaminated soils that do not contain other contaminants, such as solvents, as a special category. Under current DEP guidelines, excavated soils that contain greater than 300 parts per million (ppm) of total petroleum hydrocarbons cannot be disposed of in unlined landfills. These soils can only be disposed of in lined, certified landfills with DEP authorization. Soils that contain greater than 3,000 ppm total petroleum hydrocarbons cannot be landfilled, and must be disposed of at appropriate out-of-state treatment facilities or at asphalt batching plants. Each asphalt batching facility in the Commonwealth has its own DEP-approved upper limit for oil in soils, generally in the range of 60,000 ppm total petroleum hydrocarbons (6 percent oil). Soils that exceed the oil content cutoffs must be disposed of under hazardous waste rules at hazardous waste treatment facilities. Soils that contain other contaminants must be disposed in accordance with requirements applicable to such contaminants. Soils that do not contain oil or other hazardous materials will be disposed of at a DEP-approved solid waste landfill. Such disposal will be in accordance with applicable requirements.

Solid Waste Generation During Project Operations

Operation of the New Boston Garden is expected to generate a slightly higher amount of solid waste than the existing Boston Garden, because of the increase in the seating capacity of the new facility. The nature of the waste materials is not expected to change. It is anticipated that the waste generation will be approximately 102 tons per year, approximately 6 percent higher than the current annual waste generation. The New Boston Garden will utilize a new 42 cubic yard dumpster equipped with a compactor. This dumpster will be located in the truck dock area in the north corner of the building. Trash removal and disposal will continue to be handled by an independent, licensed contractor.

Based on industry standards[1] the commercial component of the project will generate solid waste typical of office, retail, and restaurant establishments that will be located in the complex. It is anticipated that the office component will generate approximately 58,500 cubic yards per year (2,340 tons) and the retail component will generate approximately 6,050 cubic yards per year (200 tons). The specific quantities of waste will be calculated once schematic design of the commercial component is complete. All waste will be disposed by licensed waste haulers. The solid waste to be generated by the New Boston Garden Development will be handled and disposed of in accordance with applicable local and state regulations. Recycling measures, in addition to any required by applicable laws and regulations, will be implemented to the extent feasible.

CONCLUSION

The solid and hazardous wastes associated with the demolition, construction, and operation of the New Boston Garden and the commercial component of the project will be handled, transported, and disposed of according to applicable local, state, and federal guidelines. The proponent is committed to implementing waste minimization procedures and recycling wastes where appropriate.

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[1] "Approximate Solid Waste Generation Guidelines", BFI Waste Systems: Browning-Ferris Industries.

M Geotechnical Conditions

INTRODUCTION

This chapter describes the geotechnical conditions relating to the construction of the New Boston Garden Development project. The potential impacts that excavation and foundation construction may have on existing adjacent structures are discussed. The New Boston Garden will be built on air rights over the Massachusetts Bay Transportation Authority's underground garage, which is currently under construction. Portions of Building A will also be supported on portions of the MBTA underground garage. Limited excavation will be required for foundation and grade beam construction where the New Boston Garden and Building A extend beyond the limits of the MBTA underground garage. The only major excavation associated with the New Boston Garden Development is for the underground project Garage beneath Buildings B and C and the Public Concourse. The description of the excavation and foundation construction process includes a discussion of measures by which potential geotechnical impacts to the project site and surrounding area will be mitigated.

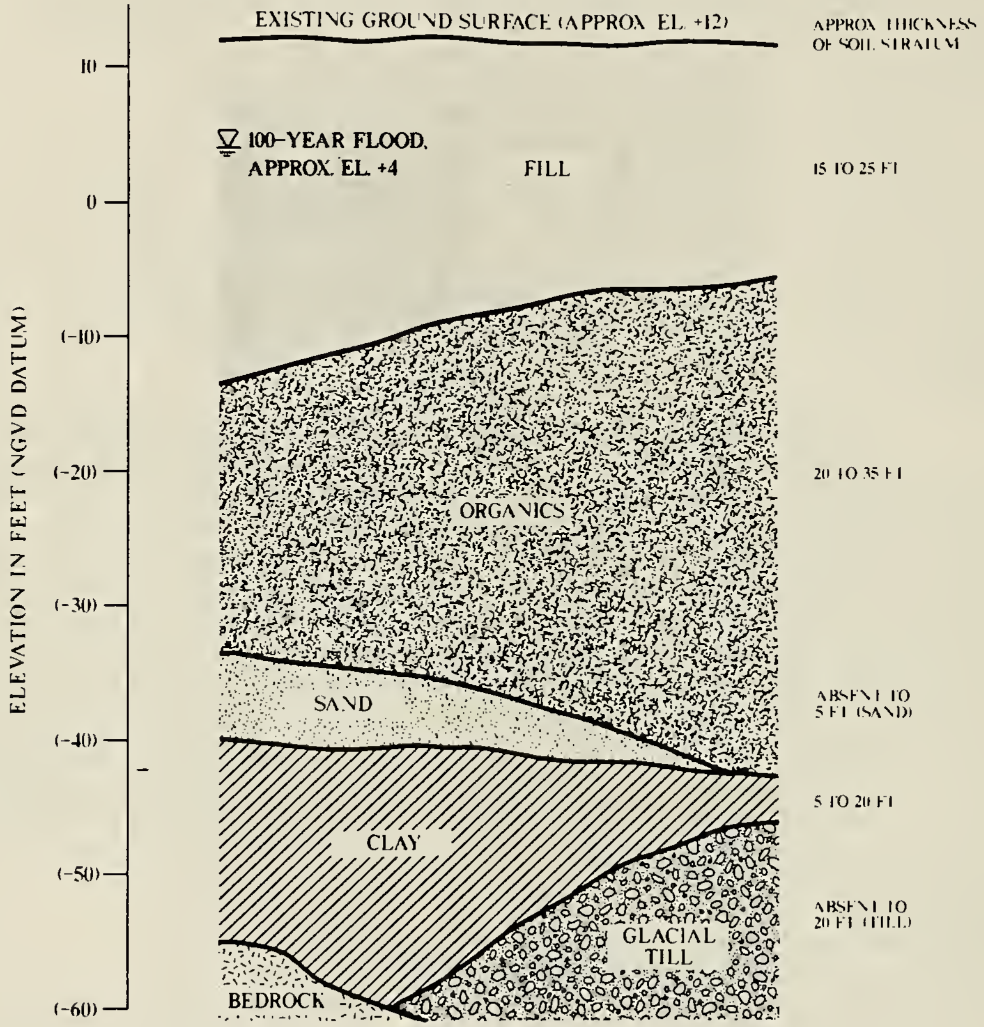
EXISTING CONDITIONS

The site is located in the North Station area which was created by filling in the Charles River estuary. Since the early 1800s, the area has been used for railroad-related activities, and in 1928, the Boston Garden/North Station building was constructed. The history of the site is described in Chapter IV-E, Historic Resources. A plan of the site is presented in Chapter IV, Area and Site Description.

Soil Conditions

The generalized soil profile of soil conditions at the site, in sequence from the ground surface down, consists of miscellaneous fill, organic silt and sand, intermittent strata of sand and gravel, silty clay, glacial till, and bedrock. An idealized soil profile is presented in Figure IV-M-1. The profile is interpolated and transitions between strata for the site may vary.

The fill is generally granular and contains varying amounts of sand, gravel, silt, cinders and fragments of brick, wood, shells, and miscellaneous building rubble--conditions typical of the Boston area. The organic soils and silty clay are



Notes:

1. The stratification lines are based on interpolations between widely spaced borings from previous studies and represent approximate boundaries between soil types.
2. Fluctuations in the level of groundwater may occur due to variations in rainfall, Charles River elevation, temperature, possible leaky utilities and other factors.

Source: Goldberg-Zoino & Associates, Inc.

Idealized Soil Profile Figure IV-M-1

compressible and are sensitive to fluctuations in the groundwater. Bedrock is Cambridge Argillite, although localized intrusions of diabase and basalt were identified in borings conducted as part of studies for and construction of the underground MBTA garage and adjacent sites. The Cambridge Argillite bedrock is typically weathered and fractured at the top, and is probably very permeable.

Groundwater Conditions

According to the US Geological Survey topographic quadrangle map of the area (USGS Boston South Quadrangle), the proposed New Boston Garden Development is a relatively flat area south of the Charles River Basin with ground surface at approximately elevation +12 feet NGVD. [1] Groundwater levels generally range between 7 and 11 feet below existing grade, which correspond to elevations between +5 feet and +1 foot NGVD. Fluctuations in the groundwater are attributed mainly to rainfall and temperature. Tidal fluctuations do not occur because the Metropolitan District Commission (MDC) maintains the level of the Charles River at elevations between approximately +1 foot and +2 feet. The 100-year flood level of the Charles River Basin is at elevation +4 feet NGVD.

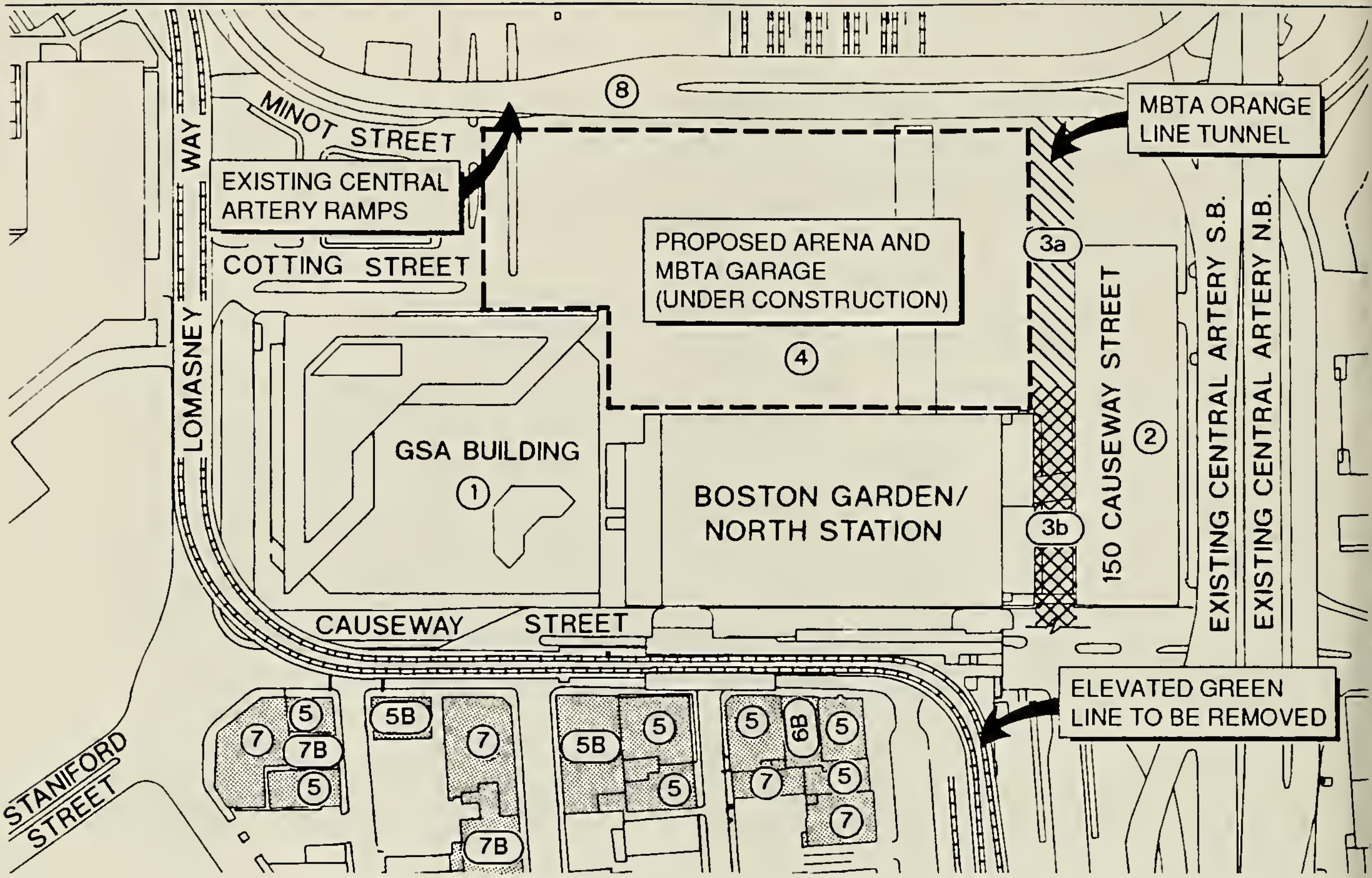
Groundwater flow is generally to the north toward the Charles River. However, infiltration into leaky underground utilities could result in localized depressions in the existing groundwater levels which will affect the direction of flow on and around the site.

Existing Building Foundations

Foundations supporting structures adjacent to the site vary depending on building size, type, and age. The larger, more recently constructed structures, such as the General Services Administration building, the MBTA underground garage presently under construction, and the Central Artery ramps, are or will be supported on foundations or piles bearing on either the glacial till or bedrock below the compressible clay and organic deposits. Older structures in the Bulfinch Triangle area and the existing elevated MBTA Green Line on Causeway Street are supported on either timber piles or caissons on the clay stratum. These structures are susceptible to settlement associated with compression of the clay layer due to potential lowering of groundwater levels outside the site. In addition, depression of the groundwater table as a result of infiltration into leaky utilities may have already adversely impacted timber pile foundations in the vicinity which are susceptible to rotting if above the groundwater level.

Figure IV-M-2 indicates foundation types for various structures in the vicinity of the project site based on a review of building permits at the City of Boston Inspectional Services Department.

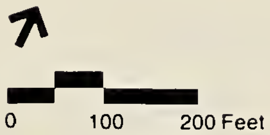
1/ National Geodetic Vertical Datum, 1929.


MINOT STREET
⑧
MBTA ORANGE LINE TUNNEL
EXISTING CENTRAL ARTERY RAMPS
LOMASNEY WAY
COTTING STREET
PROPOSED ARENA AND MBTA GARAGE (UNDER CONSTRUCTION)
④
3a
150 CAUSEWAY STREET
②
EXISTING CENTRAL ARTERY S.B.
EXISTING CENTRAL ARTERY N.B.
GSA BUILDING
①
BOSTON GARDEN/ NORTH STATION
3b
CAUSEWAY STREET
ELEVATED GREEN LINE TO BE REMOVED
STANIFORD STREET
⑤
⑦
7B
5B
6B

Building/ Structure	Foundation Type
1	Steel "H" piles and precast concrete piles to till/rock
2	Timber piles to clay or till with steel pipe pile underpinning on west side
3a	Concrete mat on till
3b	Timber piles to till
4	Caissons and slurry wall to rock
5	Stone/masonry foundation. More detailed information either not available or inconclusive with regard to foundation type. However, it is anticipated that foundations are supported on timber piles or caissons at or near top of clay.
6	Caissons, possibly to clay
7	Stone foundation on piles, possibly to clay
8	Vertical and battered piles to clay or rock

Notes:

1. "B" indicates the presence of a basement
2. Foundation information based on preliminary review of building permits available at Boston Inspectional Services



Source: Goldberg-Zoino & Associates, Inc.

Existing Foundations Figure IV-M-2

Foundation Construction

Foundation construction activities are not expected to result in ground movements that will adversely affect adjacent structures and utilities. However, some ground movement may occur as a result of performing the excavation. Excavations were performed at Rowes Wharf and the Post Office Square garage which involved similar construction techniques to those proposed for the New Boston Garden Development. Subsurface conditions for Rowes Wharf and the Post Office Square garage are comparable to those of the proposed development, and these projects apparently did not adversely impact adjacent buildings and utilities.

Construction techniques for the underground project Garage will essentially be the same as that being used for construction of the MBTA underground garage. Structures closest to the excavation are either supported on deep foundations (e.g., the GSA Building and the completed MBTA underground garage) or will be demolished (150 Causeway Street), prior to proposed construction and therefore, will not be impacted. Existing groundwater levels will be maintained through slurry wall foundation construction techniques, to avoid damage due to settlement of compressible soils or rotting of timber piles. Slurry walls will serve as an effective groundwater cutoff and, if needed, a program of groundwater recharge will be implemented. The project will not adversely impact the hydraulic connection between the Charles River and the local groundwater pattern in the immediate project area. A construction monitoring program will be developed to monitor building and ground movement and groundwater levels both during and after construction. Chapter IV-N, Construction, provides a detailed description of construction techniques and activities associated with the New Boston Garden Development.

New Boston Garden

The New Boston Garden will be supported as an air rights structure on the MBTA underground garage currently under construction. The excavation, handling, and removal of soil associated with MBTA underground garage construction is the responsibility of the MBTA and was considered in the MEPA review of the project.

The New Boston Garden will extend beyond the limits of the northeast corner and the east end of the MBTA underground garage. Therefore, foundation elements separate from those supporting the MBTA garage will be required. Although foundation design is not yet complete, it is anticipated that foundation installations (caissons) along the east side of New Boston Garden will require drilling through pile caps of the 150 Causeway Street building where the pile caps extend beyond the face of the building. Since these pile caps have been underpinned as part of construction of the MBTA Orange Line in Accolon Way, foundation installation is not expected to impact the 150 Causeway Street building. The building is scheduled for demolition in 1992 to accommodate construction of the Central Artery.

The northeast corner of the New Boston Garden will be supported on an extension of the eastern MBTA underground garage slurry wall, and the east wall will be supported on rock-socketed load-bearing elements and caissons. Excavation associated with construction of the New Boston Garden will be limited to removal of soil for caisson installation and grade beam construction, since no below-grade space beyond the MBTA underground garage is planned. Also, groundwater lowering will not occur. Other than possibly drilling through pile caps of 150 Causeway Street, there will be no impact on adjacent structures and utilities associated with the installation of these foundation elements. The impact on the pile caps will not affect the structural integrity of 150 Causeway Street.

Commercial Component

The commercial component consists of Buildings A, B, and C, a Public Concourse, and an underground Garage. Building A will be supported on foundations installed as part of the MBTA underground garage construction, as well as on additional caissons to support the west portion of the building, which will extend beyond the limits of the MBTA underground garage. Buildings B and C and the Public Concourse will be founded on the six-level underground project Garage constructed on the site of the existing Boston Garden.

Underground Project Garage. Excavation along Causeway Street will be made for a six-level below-grade parking garage, which will serve as the foundation for Buildings B and C and the Public Concourse. Excavation and construction techniques used for the garage are described below.

Excavation of fill, organic silt and sand, sand and gravel, silty clay, and glacial till will be required to a depth of approximately 65 feet for construction of the six-level underground project Garage. Some rock removal may be required. Site excavation will also include the removal of existing subsurface obstructions such as abandoned utilities, remnants of foundations, and building debris. This material will be removed from the site and disposed of in accordance with state and federal regulations (see Chapter IV-L, Solid and Hazardous Waste). Functioning utilities serving the site will be capped, while those on-site will be re-routed with minimum disruptions to service.

Foundation construction is expected to utilize the "up-down" construction technique which was employed at Rowes Wharf and the Post Office Square garage and is currently being used in the construction of the MBTA North Station underground garage. This construction technique provides many environmental benefits. In comparison to other construction techniques, up-down construction minimizes ground movements (settlement) and lowering of the groundwater table in areas surrounding the construction site. Also, this method of construction will allow the erection of the building superstructure simultaneously with the construction of the underground parking garage. This method shortens the overall construction period, eliminates the need for tie-backs extending outside the limits of the site, and reduces noise and dust. In addition, early completion of the ground floor slab will reduce the amount of rainfall entering the excavation. This will reduce the amount of dewatering required during construction and will reduce the potential impacts to the surrounding waters receiving the discharge.

The "up-down" construction process is summarized as follows: slurry walls are installed to form the basement foundation wall, as well as to support the excavation and provide a groundwater cutoff. Foundations for interior columns are installed using slurry construction techniques. Prefabricated columns are installed on the caissons for support of the below-grade parking decks. The floor slab at existing ground level is then installed, providing bracing for support of the slurry walls and allowing excavation to continue. Holes are left in the slab through which equipment and excavated soil from the lower levels can be accessed. Each subsequent lower level is excavated and the concrete floor slab placed. As excavation proceeds, above-grade construction begins (i.e., up-down). Pumping of groundwater from within the excavation is not allowed until slurry wall construction is completed and provides a continuous groundwater cutoff around the perimeter of the site.

Since the top of the bedrock in the area of the site is typically weathered and pervious, provisions for mitigating measures to maintain groundwater levels outside the site will be included in the design. One means of accomplishing this is to install PVC sleeves in the slurry walls through which grout can be injected into the rock to create a more effective groundwater cutoff. Groundwater recharge systems may also be employed as instrumentation installed as part of the construction monitoring program dictates.

As in the case of the MBTA garage, the base slab will not be designed to resist hydrostatic uplift pressure. An underslab drainage system will be required to prevent buildup of hydrostatic pressures on the bottom of the structure at the lowest level slab. Based on subsurface data from the adjacent MBTA underground garage, discharge from the underdrain system due to groundwater infiltration will be minimal--less than 50 gallons per minute (gpm) is anticipated. Further analyses to evaluate the discharge rate will be performed after completion of subsurface explorations for the project Garage.

Buildings B and C and Public Concourse. Buildings B and C and the Public Concourse will be constructed above the project Garage. Since there will be no below-grade construction, there are no geotechnical-related issues.

Building A. Most of Building A will be supported on the foundations of the MBTA underground garage. The west end of the building and a truck ramp along the north side of the building will extend beyond the limits of the garage and will therefore require separate foundations. As is the case for the New Boston Garden, these foundations will consist of rock-socketed caissons which will have to be located to avoid interference with the MBTA Green Line subway structure at the west end of the site and a sewer which will be relocated along the west wall of the MBTA underground garage as part of the current MBTA project. Since there will be no basements where Building A will extend beyond the MBTA garage, excavations will be limited to removal of soil for caisson installation and grade beam construction. Groundwater lowering will not be required in connection with this work.

Foundation installation and excavation are not expected to adversely impact adjacent structures or utilities. Groundwater levels will not be adversely affected.

Construction Monitoring Program

Construction of the Garage below Buildings B and C and the Public Concourse will require excavation adjacent to existing structures such as the New Boston Garden/MBTA underground garage, the GSA building, the MBTA Orange Line subway tunnel, and the elevated MBTA Green Line structure on Causeway Street, as well as active utilities which must be protected. The Anelex Building (150 Causeway Street) is expected to be demolished prior to construction of Buildings B and C and the Public Concourse.

Available subsurface data have indicated layers of soft organic soils, compressible clay, and highly weathered bedrock. The organic soils and clay are sensitive to settlement due to groundwater lowering. The bedrock may be pervious due to the extent of weathering, and thus, additional care will be taken to provide groundwater cutoff. A construction monitoring program using geotechnical instrumentation and optical survey will be used to reduce potential negative impacts to adjacent structures by providing a basis for determining the need for additional mitigation measures.

There are numerous instruments and techniques available to monitor construction. A program will be selected based on site geology and proposed construction methods and sequencing. Instruments will be selected to monitor general performance of the earth support system, ground movements, horizontal and vertical building movement, vibrations, water levels, and pore pressures. Such instruments could include observation wells, piezometers, surface reference points, building reference points, vibration monitors, inclinometers, and possibly, combined inclinometer/Sondex systems. The wells and piezometers will be installed outside the excavation to monitor groundwater levels adjacent to the excavation as well as at adjacent structures. Inclinometers will be installed adjacent to the earth support system to monitor for lateral soil and wall movement. Sondex systems measure vertical soil movement at preselected depths below ground surface. The instruments will be installed prior to excavation to establish baseline data and then read periodically throughout construction to monitor geotechnical conditions during construction. A program of rapid response measures will be developed to be used if necessary. The proponent will coordinate with the MBTA, GSA, BWSC, area landowners, and the City of Boston in the implementation of the geotechnical monitoring program.

Project specifications will include provisions for preplanned remedial measures so that the contractor could promptly remedy ground movements or lowering of groundwater levels if indicated by the construction monitoring program. Threshold movement and groundwater drawdown criteria will be established prior to construction.

CONCLUSION

Foundation construction associated with construction of the New Boston Garden Development is not expected to adversely impact existing structures or groundwater conditions in the area of the site. A construction monitoring program will be developed to assure prompt response to any changes in geotechnical conditions through implementation of preplanned remedial measures.

N Construction

INTRODUCTION

This chapter describes the construction sequencing for the New Boston Garden, the Public Concourse, and the commercial component of the New Boston Garden Development. The major project activities and construction techniques are described for the duration of the construction period. The probable short-term environmental impacts that may occur as a result of construction activities are summarized in this chapter and are presented in greater detail in other chapters in this document (See Chapter IV-A Transportation; Chapter IV-B Air Quality; Chapter IV-C Noise, Chapter IV-L Solid and Hazardous Waste; and Chapter IV-M Geotechnical Conditions). The description of probable impacts also includes a discussion of the potential measures to mitigate construction impacts.

Construction of the New Boston Garden Development will occur simultaneously with several major public construction projects. On the same site as the New Boston Garden Development, the Massachusetts Bay Transportation Authority (MBTA) is building an underground parking garage and a new commuter rail station at North Station. The New Boston Garden will be built in air rights above the MBTA garage. In addition, the MBTA plans to relocate the Green Line to an underground alignment between Haymarket Station and the elevated tracks near the Registry of Motor Vehicles approaching Science Park Station. Portions of the Green Line tunnel will run through the second and third levels of the MBTA garage, as well as through the project Garage beneath Building C. The timing of these two projects is discussed in conjunction with the construction sequencing of the elements of the New Boston Garden Development.

In addition to the projects occurring on-site, several major roadway construction projects are scheduled to be undertaken in the vicinity of the site. These include: depression of the Central Artery; improvements to Causeway, Nashua, and Merrimac Streets; and removal of the elevated Green Line. Depression of the Central Artery will require the demolition of 150 Causeway Street (Anelex Building) initially for construction staging, and later for the construction of ramps. An understanding of the construction schedules of these public projects is important to provide the context for the various activities that will be occurring simultaneously on or near the project site.

Construction of the New Boston Garden Development is scheduled to begin in mid-1991 and to be completed in late 2000. Table IV-N-1 summarizes the scheduled beginning and completion dates for each of the structures comprising the New Boston Garden Development.

Table IV-N-1 **PROJECT CONSTRUCTION SEQUENCING***

	Construction Begins	Construction Completed
New Boston Garden	Mid-1991	Late-1993
Underground Project Garage, Building C, and Public Concourse	1994	1995
Building B	1996	1998
Building A	1998	2000

* The construction schedule for the New Boston Garden is based on a Fall 1993 opening. The construction dates for the remaining buildings are based on information currently available and are subject to change. Construction of Building A is anticipated to begin late 1998.

EXISTING SITE AREA

The New Boston Garden Development site is located on parcels currently occupied by and adjacent to the existing Boston Garden. At present, Boston Garden occupies a parcel fronting on Causeway Street, behind which is the site of an underground parking garage currently under construction by the MBTA. The New Boston Garden will be constructed in air rights above the underground MBTA parking garage. Buildings B and C and the Public Concourse will be built on the site of the existing Boston Garden. Building A will be built on the parcel north of the General Services Administration (GSA) Building and west of and partially in air rights above the MBTA parking garage.

DEVELOPMENT CONDITIONS

Three development conditions have been analyzed for this Draft EIR/PIR. These are the No-Build, the 1995 Interim-Build, and the 2000 Full-Build conditions. Each is described briefly below.

No-Build

In the event that the New Boston Garden Development is not built, the construction-related impacts described in this section would not occur. It is assumed that the existing Boston Garden/North Station building will require significant repair and on-going maintenance, although the various mechanical systems would be infeasible to repair. It is also assumed that public access to the commuter rail platforms would be maintained through the existing Boston Garden/North Station building. The MBTA underground garage is being built on the parcel behind the existing Boston Garden. If the New Boston Garden Development is not built, construction of the MBTA Green Line under the site of the existing Boston Garden would require underpinning of the existing Garden.

This would have significant cost implications for the MBTA. Additionally, this condition assumes provision to the proponent of a staging and storage facility, with arena vehicular access to replace facilities and access currently provided by 150 Causeway Street.

1995 Interim-Build

Interim-Build conditions for the project consist of the New Boston Garden, the underground project Garage, Building C, and the Public Concourse. The New Boston Garden is scheduled to be completed in 1993, and Building C and the Public Concourse are anticipated to be completed by the end of 1995. There is only one underground parking garage that is to be built beneath Buildings B, C, and the Public Concourse, and is termed the project Garage. The MBTA underground parking garage, while built beneath the project site, is not part of the proposed project. The New Boston Garden will be built over air rights to the MBTA underground garage and the at-grade North Station commuter rail facility.

2000 Full-Build

The Full-Build condition consists of the 1995 Interim-Build condition with the addition of Building B and Building A. Figure IV-N-1 shows the various components of the New Boston Garden Development and illustrates which components are below-, at-, and above-grade. The following section describes the construction activities involved in the project, proposed construction techniques, and potential construction impacts associated with the New Boston Garden Development.

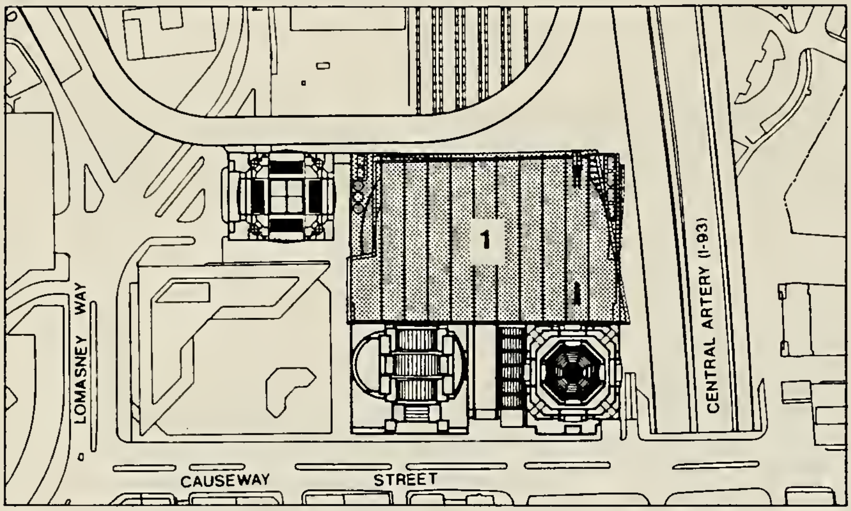
CONSTRUCTION ACTIVITIES AND TECHNIQUES

The New Boston Garden Development is a complex and carefully planned project. Due to site constraints and the need for coordination with other construction projects occurring on-site, construction activities and techniques will be selected which account for geotechnical and other physical conditions and will attempt to minimize conflicts with commuter rail operations and ongoing construction activities.

The following section describes the construction activities and techniques that will be used to construct the New Boston Garden Development. Specific construction techniques for building foundations are discussed in greater detail in Chapter IV-M, Geotechnical Considerations. The description of construction activities for Buildings A, B, C, and the Public Concourse is based on preliminary master planning concepts.

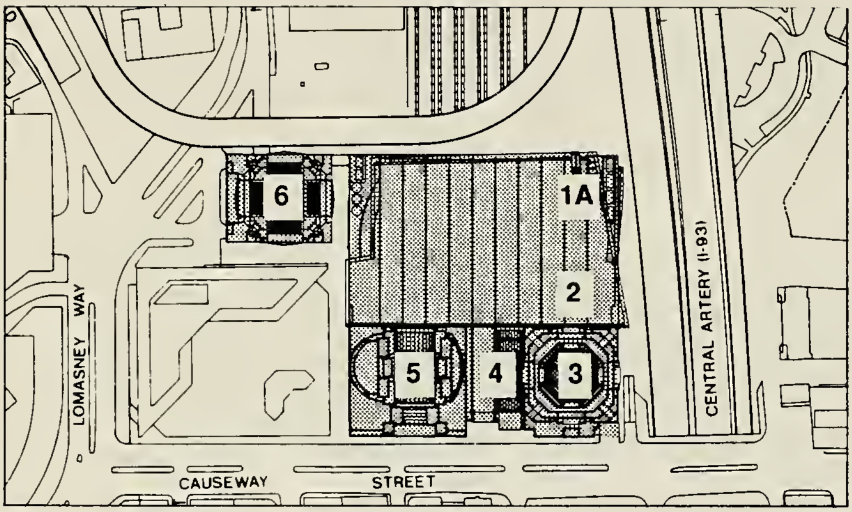
Demolition of Existing Structures

Before construction on the project Garage can begin, the existing Boston Garden building will be demolished. Demolition of the existing Boston Garden will be accomplished using standard mechanical techniques and equipment, such as wrecking balls and front-end loaders. Dismantling of masonry may require use



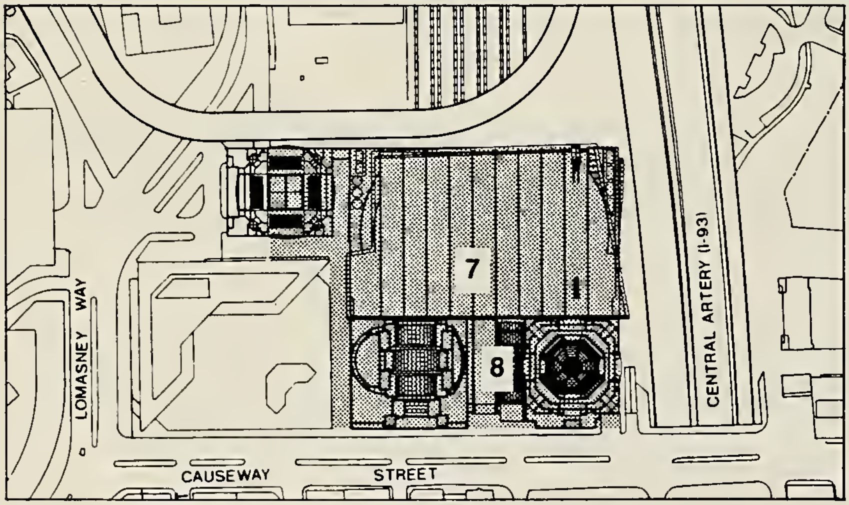
Above-Grade

1. New Boston Garden Arena



At-Grade

1A. Arena Service Area
2. MBTA Commuter Rail Platforms
3. Building C
4. Public Concourse
5. Building B
6. Building A



Below-Grade

7. MBTA Garage
8. Project Garage

Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Project Components
Above-, At- and Below-Grade
2000

Figure IV-N-1

of cranes and clam buckets. Implosives are not planned to be used in any aspect of the demolition process. Fences or barriers will be constructed as necessary around areas slated for demolition in order to separate these areas from nearby pedestrian activity and/or potentially affected on-site uses. Demolition sites will be properly secured during non-working hours, and personnel will monitor the area at all times.

Demolition debris from the Boston Garden/North Station building is expected to consist primarily of building materials such as brick, structural steel, concrete, asphalt, wood, glass, and metals. All such refuse generated by demolition will be disposed of at appropriately licensed solid waste facilities. Section IV-L, Solid and Hazardous Waste discusses demolition debris in greater detail.

Removal of Hazardous Materials

Prior to the demolition of the Boston Garden/North Station building, all potentially hazardous materials used or stored in the building will be removed. These materials could include asbestos, heating oil, hydraulic fluid, freon and other refrigeration materials. All hazardous materials will be handled and disposed of in accordance with applicable federal, state and local requirements. Additional information is provided in Section IV-L, Solid and Hazardous Waste.

"Up-Down" Construction

The "up-down" method of construction will be used for the proposed development along Causeway Street. This method of construction, which is described in greater detail in Chapter IV-M, Geotechnical Conditions, involves the installation of permanent deep-foundation elements (slurry walls and caissons, in this case) from grade early in the construction process and the installation of an at-grade slab. This will allow the erection of Building C and the Public Concourse, simultaneously with the construction of the underground project Garage.

This method is similar to the technique being used to construct the above-grade New Boston Garden simultaneously with the construction of the underground MBTA parking garage. Once the top slab has been completed, the MBTA will continue with below-grade construction while the New Boston Garden is simultaneously constructed above-grade. "Up-down" construction minimizes environmental impacts from dust and noise since construction occurs under a concrete slab. This method eliminates the need for tie-backs, and reduces the need for dewatering, since less precipitation can enter the construction cavity. This technique allows for the simultaneous construction of below- and above-grade projects resulting in a reduction of the overall construction period.

Excavation

The excavation required for the New Boston Garden Development will be for the project Garage beneath Buildings B and C and the Public Concourse. Excavated soil will be classified based on available test data and will be disposed of in accordance with current Department of Environmental Protection policies. Excavation is discussed further in Section IV-L, Solid and Hazardous Waste.

Foundations

The New Boston Garden will be constructed in air rights above the MBTA garage and commuter rail station. The new arena will be primarily supported by foundations constructed as part of the MBTA garage. Foundations separate from those of the MBTA garage will be required to support the New Boston Garden where it extends beyond the limits of the MBTA garage, at the east end and northeast corner of the structure. Similarly a portion of Building A will be supported on the columns supported on the foundations of the MBTA garage. The west end of Building A and a truck ramp along the north side of the building extend beyond the limits of the MBTA garage and, therefore, will require separate foundations.

Foundations of the New Boston Garden Development are expected to consist of reinforced concrete slurry wall and rock-socketed caissons. This system allows for the "up-down" construction method to be used as opposed to conventional construction which requires excavation to the lowest slab level to install the foundation. The use of conventional construction techniques would dictate that the construction of the above-grade portion of the project could only begin once the garage is complete.

Slurry walls will be installed as the earth support system and groundwater cutoff. The walls will also serve as the permanent foundation wall which supports the above grade structure. Installation of slurry walls generally involves pretrenching through the fill in areas suspected to contain obstructions. This is followed by backfilling with either soil or lean concrete. Concrete guidewalls are then formed and poured to serve as a template through which a clamshell is guided during excavation for the wall. Excavation proceeds using a drilling fluid (slurry) to maintain an open hole. At the designed base of the wall, excavation stops, the hole is cleaned, often using an air lift technique to remove sediments collected at the bottom of the hole. The steel reinforcing cage is placed and then concrete is tremied into the hole to complete the wall.

Caissons, which are inherent in the "up-down" method of construction, will be used to support columns within the limits of the slurry wall. These foundation elements will be installed by augering through the existing fill, organic soils and clay to a specified depth into the underlying glacial till and bedrock. Steel casing is typically used to support the sides of the hole in the fill and organic soils. Below the organic soil, a drilling fluid, such as slurry is used. At the required bottom of the caisson, the hole is cleaned and a steel reinforcement cage and column is placed. Concrete is then tremied into the hole up to the top of the steel reinforcing. The steel column above the cage is backfilled with soil. Then as excavation proceeds from ground surface down, the column is already in place and is exposed for support of floor slabs.

Steel Superstructure, Facades, and Internal Finishes

Once the foundation work is complete for the above-grade structures, steel superstructures will be erected to form the frame of the buildings. This will be followed by installation of the buildings' mechanical systems and components and construction of building facades. Internal finishings will then follow this stage. This technique will most likely be used for all structures in the New Boston Garden Development.

Use of Pre-Assembled Elements

Pre-assembled elements such as structural framing steel and pre-cast facade elements will be used where appropriate. This will reduce the quantity of bulk materials that must be delivered to the site and will decrease the on-site duration of critical construction activities.

Construction Staging

As a result of the physical site constraints and adjacent construction projects, it is anticipated that only limited construction staging will be permitted on the site. Extensive coordination of the delivery of materials to the site will be required to allow for uninterrupted construction. The sequence of construction activities will be carefully planned to provide an orderly flow of equipment, personnel, and materials to the site.

The limited areas for site construction staging will require the identification of remote staging areas, most likely out of the city limits of Boston. Such areas would be selected based on access to the construction site (travel time), availability of space, security, and cost.

Vehicular travel to the project site in connection with construction activities will be primarily by way of the following three routes:

- I-93 southbound to the Storrow Drive off-ramp to Leverett Circle
- I-93 northbound to the Causeway Street off-ramp
- Monsignor O'Brien Highway through Leverett Circle

These routes are major arterial highways in the regional and local transportation system. They would be used by the majority of construction vehicles and for the delivery of materials.

Efforts will be made to mitigate the impact of construction worker travel to the site. Workers will be encouraged to use mass transit as much as possible to reach the project site. This may be accomplished through subsidizing "T" passes or even identifying a remote site outside the city limits of Boston and transporting the workers through a shuttle service to mass transit near the site.

Once contractors have been selected for the construction of each element of the project, the contractors will be responsible for proposing Construction Management Plans, including Traffic Maintenance Plans, to the City of Boston. These plans will present on-site and off-site staging, scheduling, operations, and travel and delivery of materials and personnel to the project site. These plans will also provide for the coordination of this project with on-site and adjacent construction projects. The plans would be reviewed by the City of Boston and final plans would be developed through negotiation with the City.

CONSTRUCTION SEQUENCING

Construction of the New Boston Garden Development is anticipated to take approximately ten years, beginning in 1991 and concluding in late 2000. Construction of the New Boston Garden is scheduled to begin in mid-1991 and to be completed by mid-1993. The existing Boston Garden/North Station building is scheduled to be demolished in 1993, and construction of the project Garage is anticipated to begin in 1994. Building C and the Public Concourse is expected to be completed in 1995. Construction of Building B is planned to begin in 1996 and be completed two years later, while construction of Building A is planned to last from late 1998 through 2000. The non-arena portions of the project will be built out as expeditiously as market, financial and on-site conditions permit in order to minimize the duration of temporary environmental and construction impacts.

There are two major on-site public construction projects that will be occurring concurrently with the New Boston Garden Development. These are the MBTA underground parking garage above which the New Boston Garden will be built, and a tunnel connecting the Green Line between Haymarket Station and the elevated tracks near the Registry of Motor Vehicles, approaching Science Park Station. The MBTA garage is located on-site, and the Green Line construction passes from the southeast to the northwest corners of the development site, beneath Building C and the project Garage, the New Boston Garden, Building A, and through the MBTA garage.

In addition to the projects occurring on-site, there are several large roadway construction projects that are scheduled to be undertaken in the vicinity of the site. These include the reconstruction of the Central Artery, improvements to Causeway, Nashua, and Merrimac Streets, and the demolition of the existing Green Line. These off-site projects are described later in this section which considers coordination with nearby construction projects. The proponent of the New Boston Garden and its development partner will develop a construction sequence schedule and plan that is compatible with the various building and roadway construction projects that are occurring during build-out.

The following is a brief description of the two on-site projects, since coordination with these projects is considered critical in planning for construction sequencing for the New Boston Garden Development.

MBTA Underground Garage

The MBTA began construction of a 1,300-space underground parking garage in June 1990. The underground garage is part of an MBTA plan to extend and raise the commuter rail tracks serving North Station. The garage is being built using the "top-down" construction technique and is scheduled to be completed by the end of 1993. Construction of the foundations of the garage involves constructing slurry walls and caissons. The MBTA will allow the proponent's contractor access to the eastern portion of the at-grade concrete slab in June 1991, which will allow the commencement of construction of the New Boston Garden. After foundation construction, the construction of the five-level MBTA garage will continue with excavation, floor construction, and utilities installation occurring sequentially by level from the top down.

MBTA Green Line Construction

The MBTA Green Line rapid transit system is being reconstructed between the Haymarket and Science Park Stations. This will include the construction of a tunnel which will run from Haymarket to the elevated tracks in the vicinity of the Registry of Motor Vehicles on Nashua Street. The tunnel will run from the southeast to the northwest corner of the site. An underground superplatform for intermodal transfers and connections will be constructed below Causeway Street. The superplatform will facilitate access between the Green Line, Orange Line, and commuter rail trains. The construction of the Green Line tunnel and superplatform has been carefully considered in planning the construction sequencing for the New Boston Garden Development.

Construction of the Green Line tunnel in proximity to the New Boston Garden Development will occur in four stages as follows:

- The first stage involves construction of the tunnel from the northwest corner of the site which is the west wall of the MBTA garage to Lomasney Way. Concurrent with this is the construction of the tunnel through Levels 2 and 3 of the MBTA garage. The tunnel construction is scheduled to begin in mid-1991 and to be completed at the same time as the underground MBTA garage (1993). Construction of the garage began in June, 1990.

- The second stage of tunnel construction, will be from the Haymarket portal to the middle of Causeway Street and is scheduled to begin construction by the end of 1991 and to be completed by the end of 1994.

- The third phase consists of construction of a portion of the tunnel extending from Lomasney Way to Science Park. Construction of this phase is scheduled to occur between the end of 1993 and the end of 1995.

- The final stage of Green Line construction is from the center line of Causeway Street below Building C and to connect with the Haymarket segment of the tunnel running through the MBTA garage. It is anticipated that the tracks for the Green Line will be installed, and all internal finishings to the tunnels and platforms will be completed in this final stage. Construction for this phase is scheduled to commence by mid-1994 and to be complete by the end of 1995. Once the underground Green Line is in operation, the existing elevated Green Line tracks over Causeway Street will be removed in 1996.

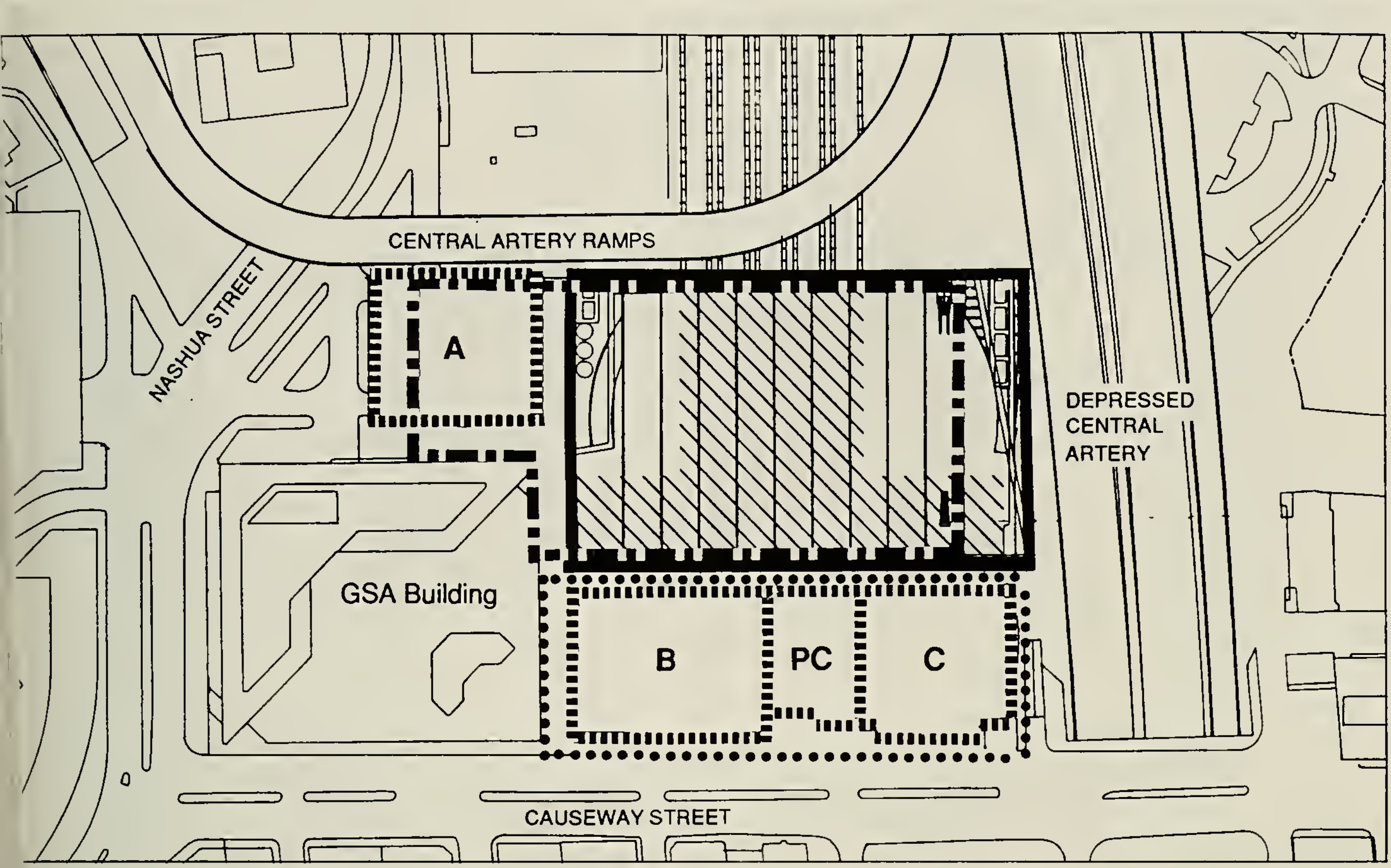
Sequential Build-Out

An analysis of the sequential build-out of the New Boston Garden was conducted for each year of the proposed construction program. The following series of diagrams illustrates the anticipated construction activities occurring in each year, the buildings or structures expected to be completed, and the status of the road network in the vicinity of the site.

The construction sequencing diagrams are based on information from the MBTA, the Central Artery project, the City of Boston Transportation Department, the architects of the New Boston Garden, and the architects of the conceptual design of the commercial component. The diagrams are based on the following assumptions:

- The diagram shows a "snapshot" of completed activities at the end of each year. Where possible activities occurring during each year are shown.
- The diagrams distinguish between the New Boston Garden, the commercial component, and the MBTA underground garage.
- Pedestrian access to the MBTA commuter rail and the New Boston Garden is maintained at all times.
- The configuration of Nashua Street shown in the diagrams takes into account the plans of the MBTA as well as those of the Boston Transportation Department.
- Construction activities associated with the depression of the Central Artery in the vicinity of the site are shown, based on current information.
- The construction schedule is established for the 1990 to 1993 period, while that for the 1993 to 2000 construction program is an estimated schedule.

Figure IV-N-2 shows the proposed project components for the year 2000, and Figures IV-N-3 through IV-N-13 show the construction sequence for each year from 1990 to 2000.



oject Components
00 Full-Build

New Boston Garden Development

▬ New Boston Garden Arena (Air Rights)

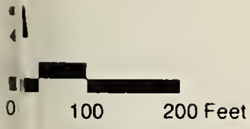
●●●●●● Project Garage (Below Grade)

▮▮▮▮▮▮ Public Concourse (PC)
Building C
Building B
Building A

MBTA

▨ MBTA Commuter Rail Platforms (At Grade)

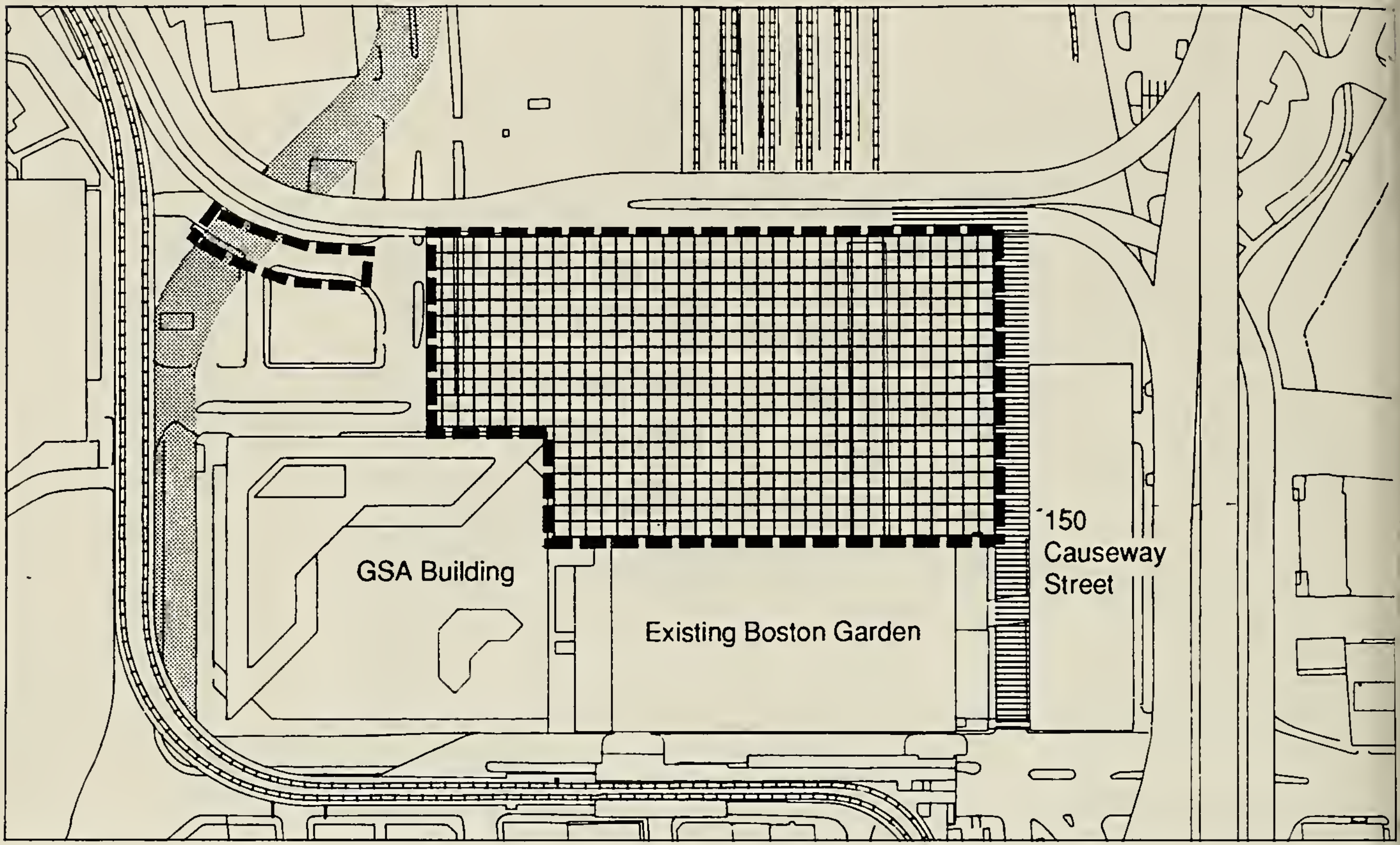
▬ ▪ ▬ MBTA Garage (Below Grade)



Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Project Components
2000

Figure IV-N-2



Activities Completed in 1990

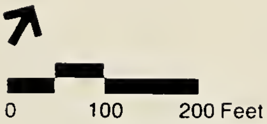
▬ ▬ ▬ Slurry Wall Construction (MBTA Garage/MBTA Green Line Tunnel)

⊞ Caissons & Garage Construction (MBTA Garage)

☰ Temporary Pedestrian Access to MBTA Commuter Rail (Walkway C Constructed and Operational from August 1990)

▒ Nashua Street (Flexible Detour to Facilitate Utility Relocation, Site Access, and Green Line Tunnel Construction)

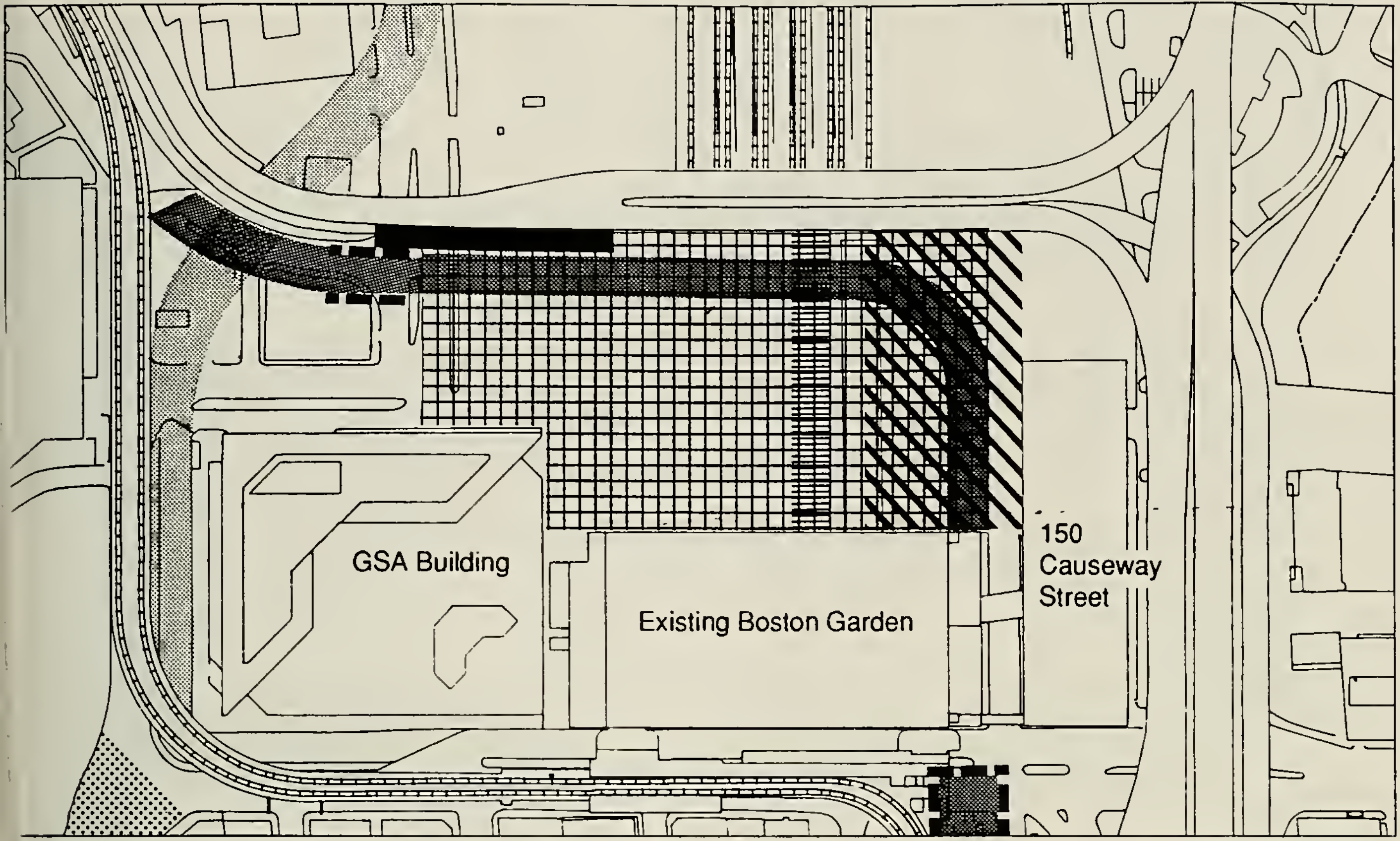
Note: Existing Boston Garden in operation. 150 Causeway Street in operation.



Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Construction Sequence
1990

Figure IV-N-3



ctivities Completed in 1991

▬ ▬ ▬ Slurry Walls for Green Line Tunnel

▦ Garage Construction (MBTA) Ground Level Slab Accessible

▧ Steel Erection (Interim Arena Service Facilities)

▩ MBTA Green Line Tunnel Construction

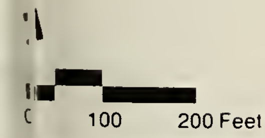
▤ Temporary Pedestrian Access to MBTA Commuter Trains (Walkway B Next to Interim Facilities: March 1991)

░ Nashua Street (Flexible Detour to Facilitate Utility Relocation, Site Access, and Green Line Tunnel Construction)

▒ Merrimac Street Improvements

■ Truck Ramp Access to New Boston Garden

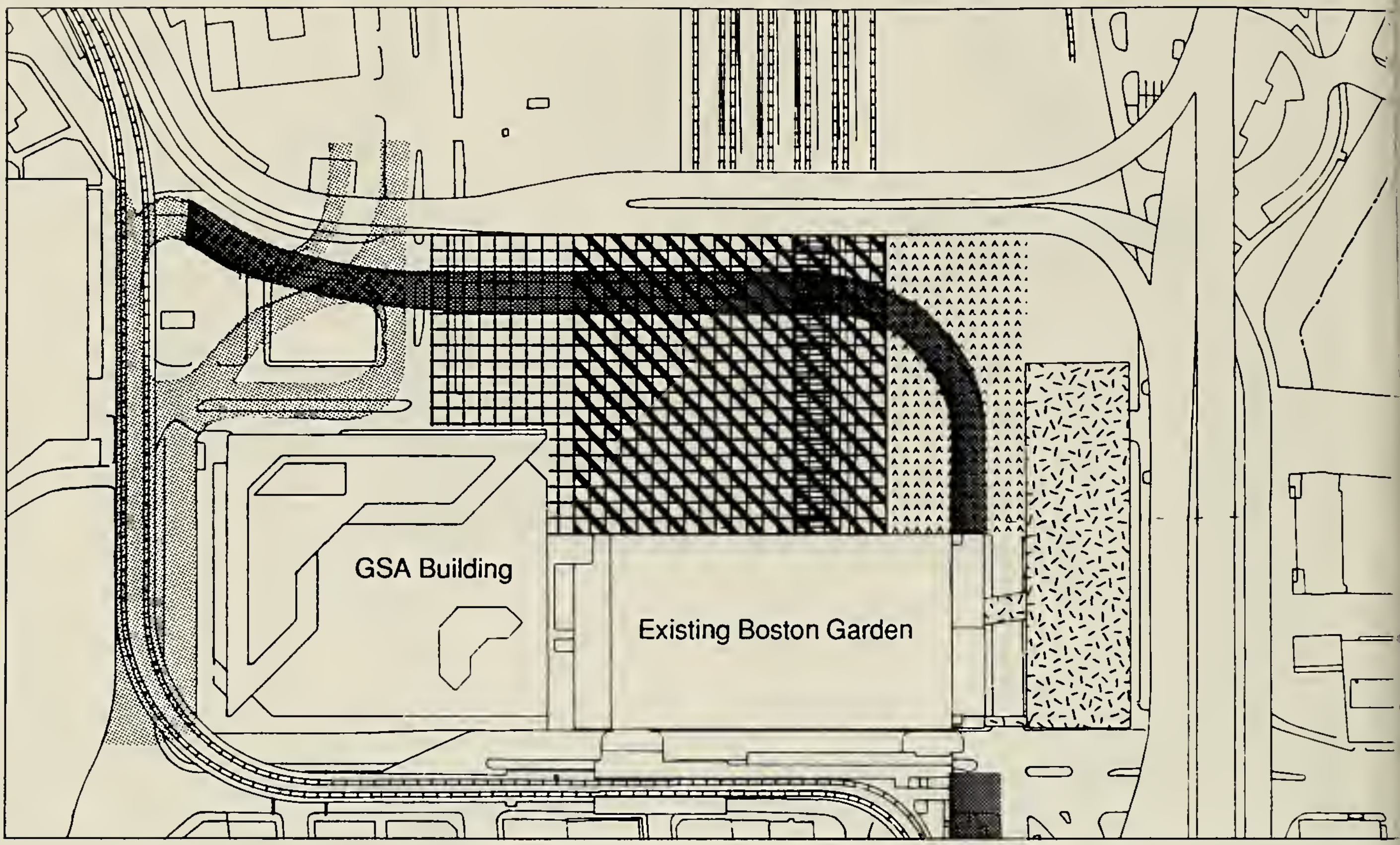
Note: Existing Boston Garden in operation.



Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Construction Sequence
1991

Figure IV-N-4



Activities Completed in 1992

▦ Garage Construction (MBTA Garage)

▧ Steel Erection (New Arena above Garage)

▵ Building Cladding/Interior Finishes (Temporary Arena Service Facilities)

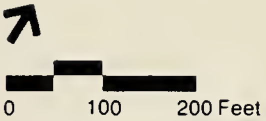
■ MBTA Green Line Tunnel and Track Construction Continues

▤ Temporary Pedestrian Access to MBTA Commuter Rail (MBTA Walkway B)

⁘ Demolition (150 Causeway Street)

░ Nashua Street MBTA Construction Alignment Under Construction

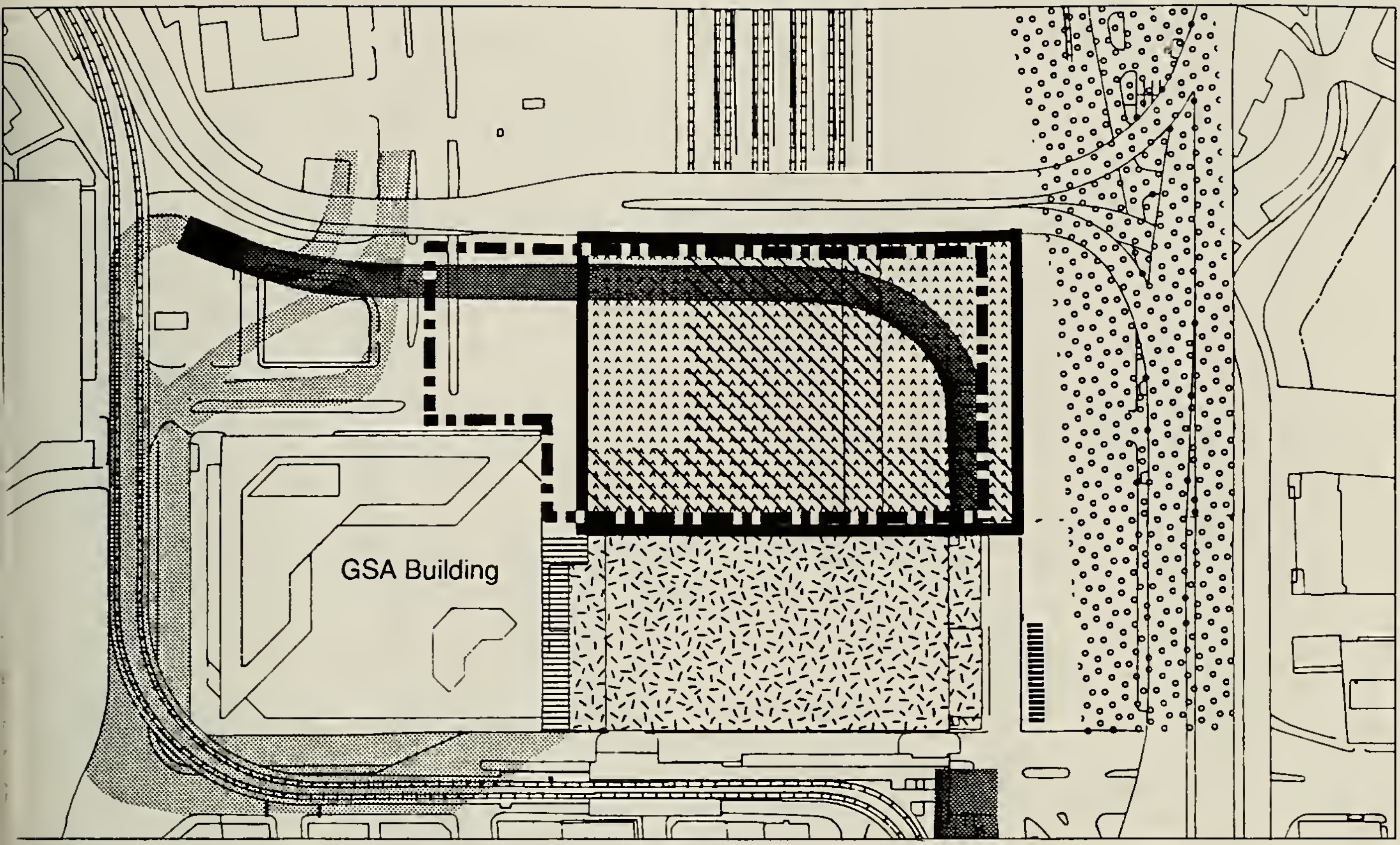
Note: Existing Boston Garden in operation. Interim Facility Occupancy August 1, 1992.



Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Construction Sequence
1992

Figure IV-N-5



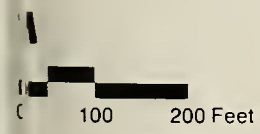
ctivities Completed in 1993

▵	Building Cladding & Interior Finishes (Arena)
⁄	Demolition (Existing Boston Garden & Western Portion Demolished First)
■	MBTA Greeen Line Construction
▒	Nashua Street MBTA Construction Alignment Under Construction/Causeway Street Improvements
☰	Temporary Pedestrian Access to New Boston Garden
○	Central Artery Construction Begins
‖‖‖	Garage Ramp Construction

ompleted Project Components

▬	New Boston Garden (Arena)*
▧	MBTA Commuter Rail Platforms at Grade*
▬ ▪ ▬	MBTA Garage (Below Grade)

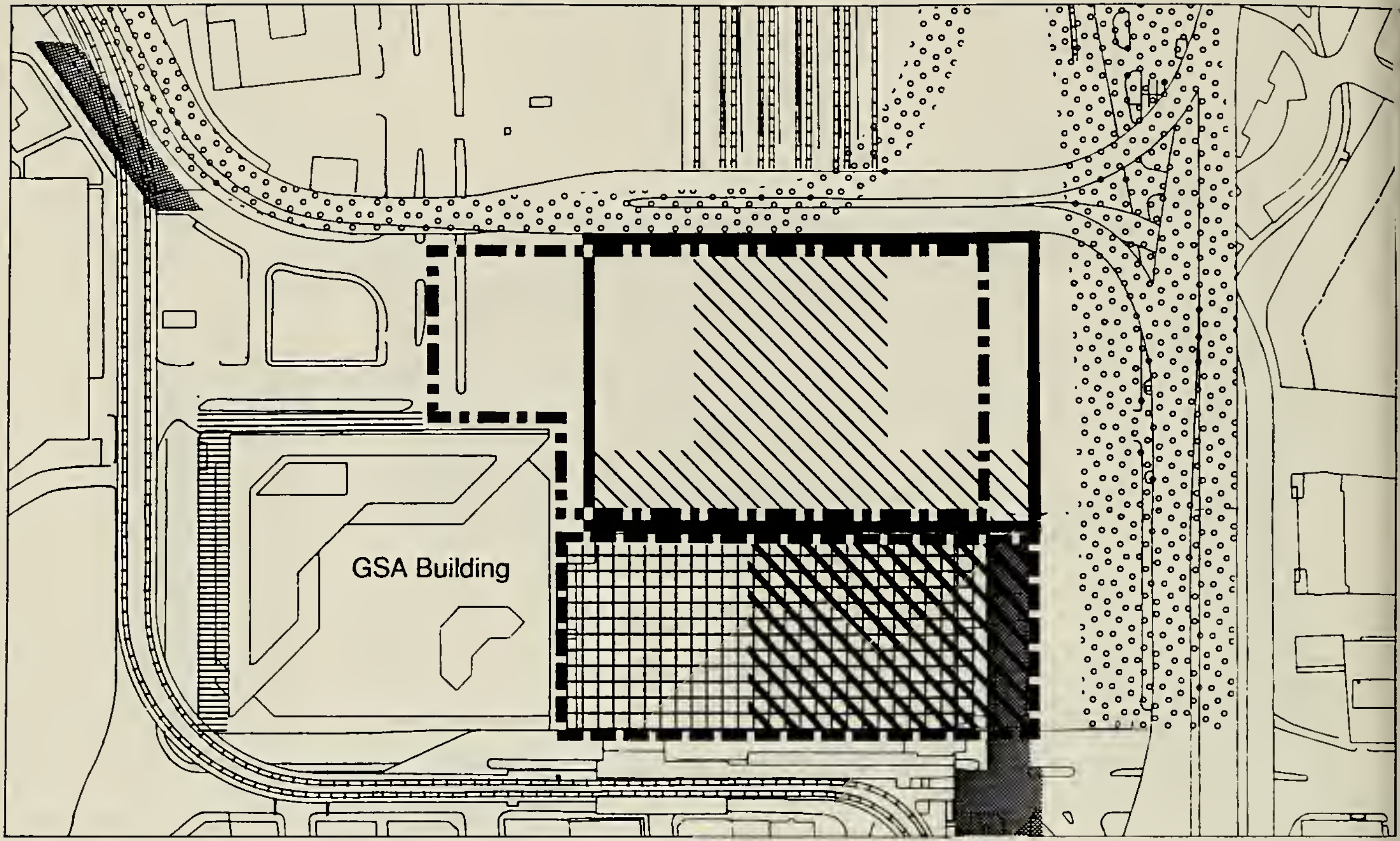
*Includes Interim ticketing facility



Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Construction Sequence
1993

Figure IV-N-6



Activities Completed in 1994

- ▬ ▬ ▬ Slurry Wall Construction
- ▦ Caissons & Garage Construction (Project Garage)
- ▧ Steel Erection (Building C/Public Concourse)
- ▩ MBTA Green Line Construction (Super Platform)
- ▤ Temporary Access (Commuter Rail & Arena)
- ⁘ Central Artery Construction Continues

Completed Project Components

- ▬ New Boston Garden Arena
- ▧ MBTA Commuter Rail Platform
- ▬ ▪ ▬ MBTA Garage (Below Grade)

Note: Nashua Street MBTA Construction Alignment in Place.

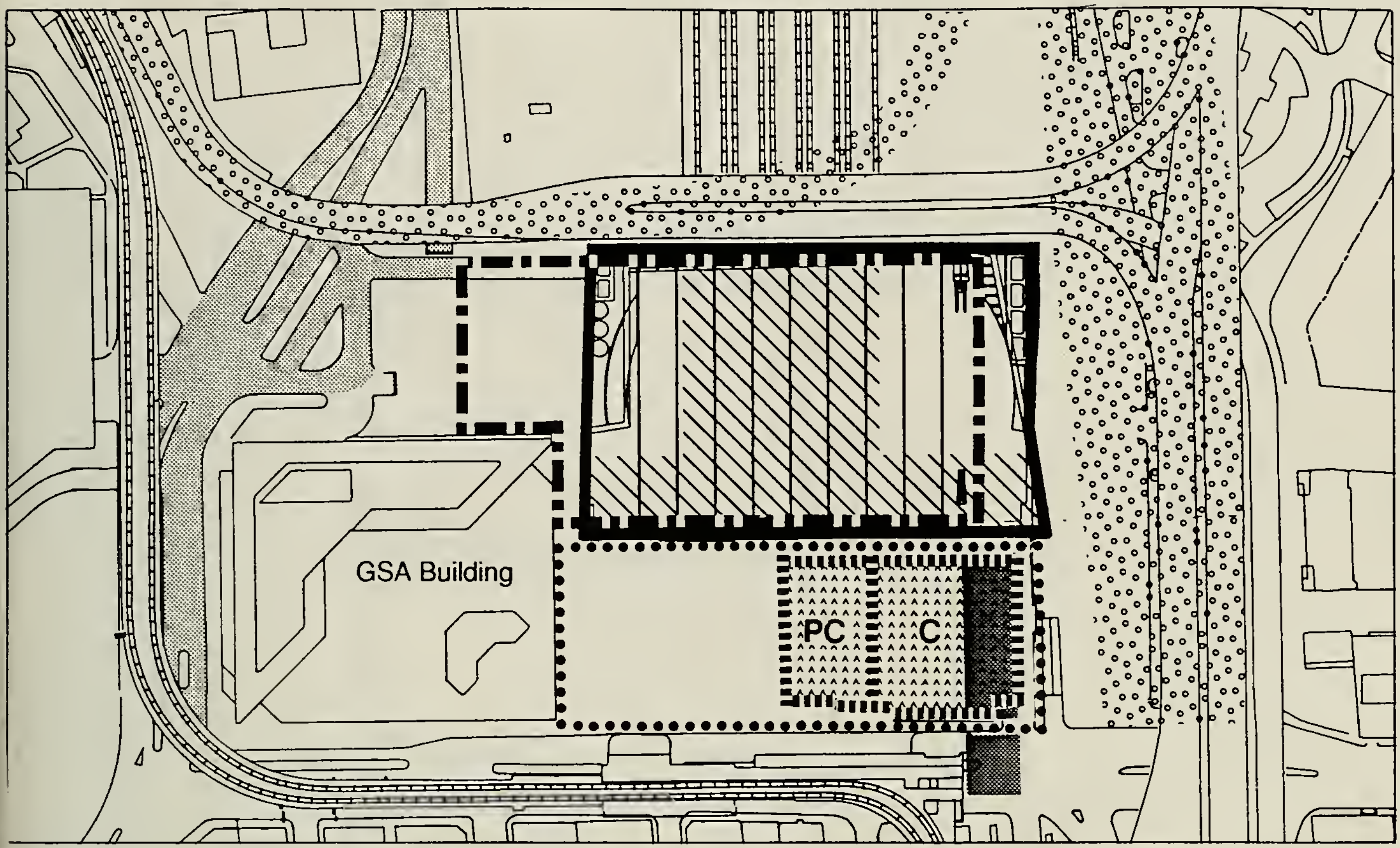
↗

0 100 200 Feet

Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Construction Sequence
1994

Figure IV-N-7



ctivities Completed in 1995

▦ Building Cladding & Interior Finishes (Building C & Public Concourse)

■ MBTA Green Line Construction Completed

▒ Nashua Street Interim Alignment

⁘ Central Artery Construction Continues

ompleted Project Components

▬ New Boston Garden Arena

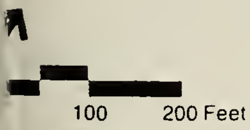
•••••• Project Garage (Below Grade)

▮▮▮▮▮▮▮▮ Public Concourse (PC)
Building C

▧ MBTA Commuter Rail Platform

▬ ▪ ▬ MBTA Garage (Below Grade)

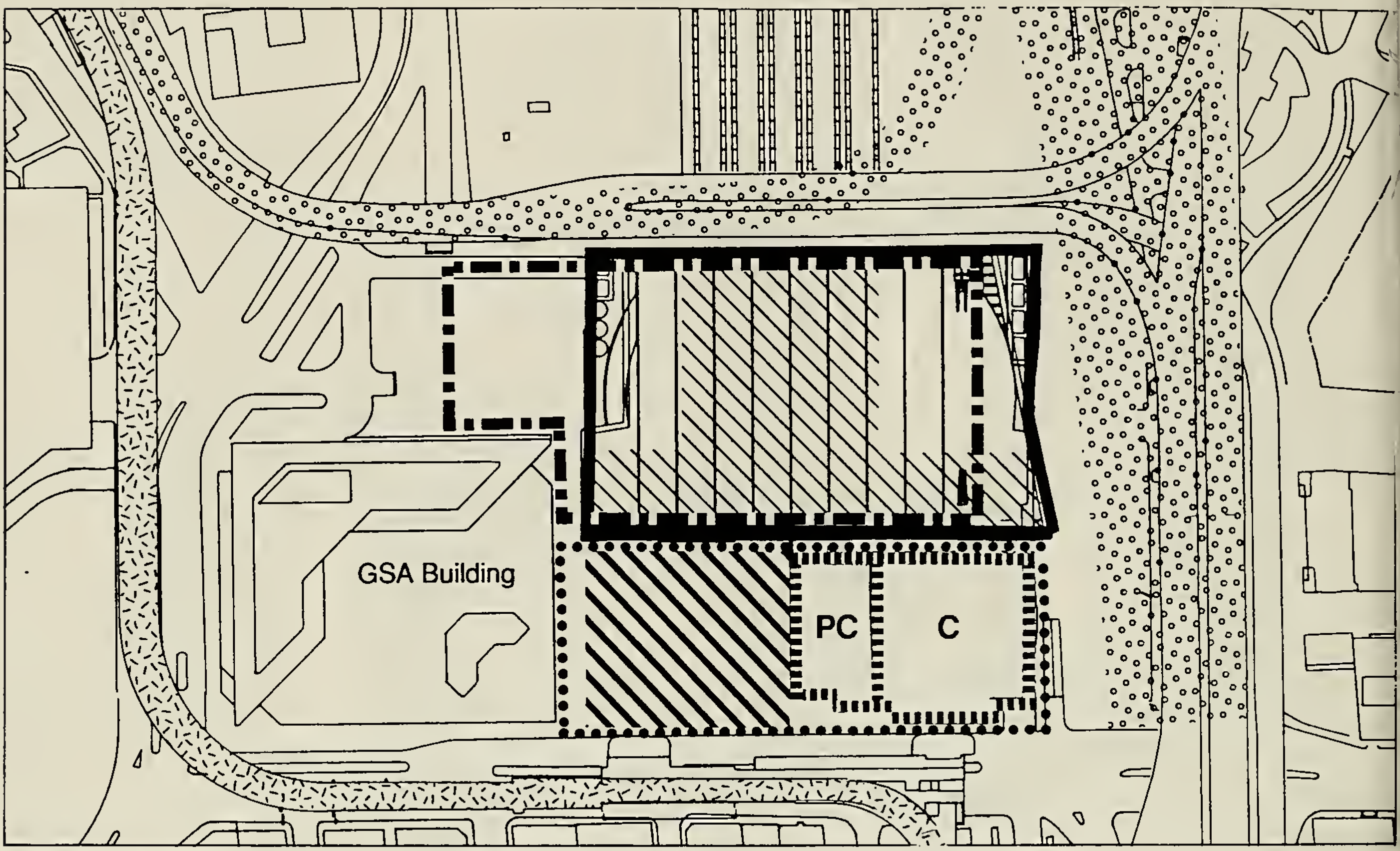
Note: From 1995 on, public access to MBTA Commuter Rail occurs through the Public Concourse. Access to Green Line and Orange Line occurs through base of Building C.



Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Construction Sequence
1995

Figure IV-N-8



Activities Completed in 1996

▧ Steel Erection (Building B)

▨ Demolition of Elevated Green Line

▨ Central Artery Construction Continues

Completed Project Components

▬ New Boston Garden Arena

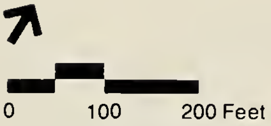
●●●●●● Project Garage (Below Grade)

▮▮▮▮▮▮▮ Public Concourse (PC)
Building C

▧ MBTA Commuter Rail Platform

▬ ▪ ▬ MBTA Garage (Below Grade)

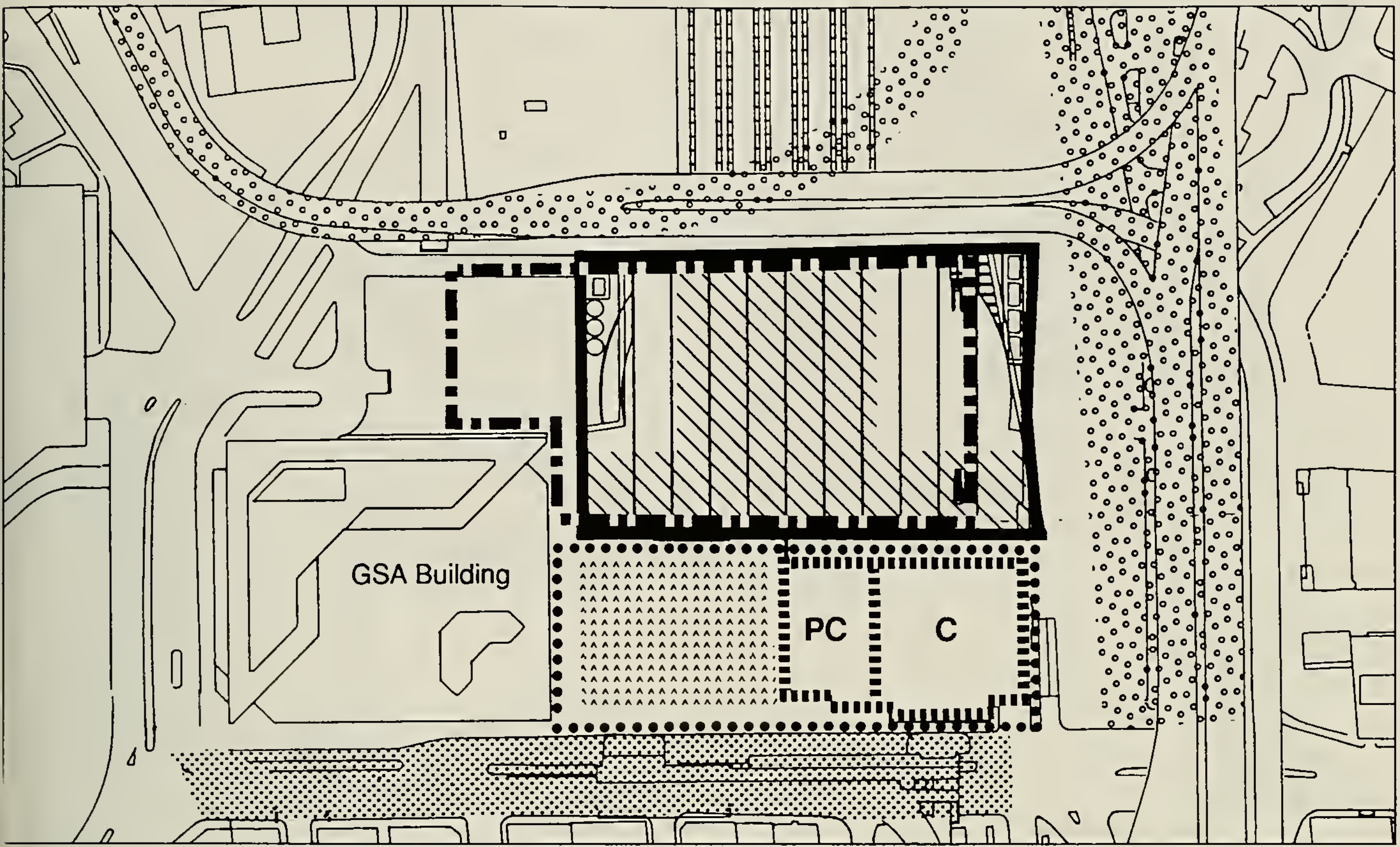
Note: Green Line tunnel constrction complete. Nashua Street Interim Alignment in place.



Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Construction Sequence
1996

Figure IV-N-9



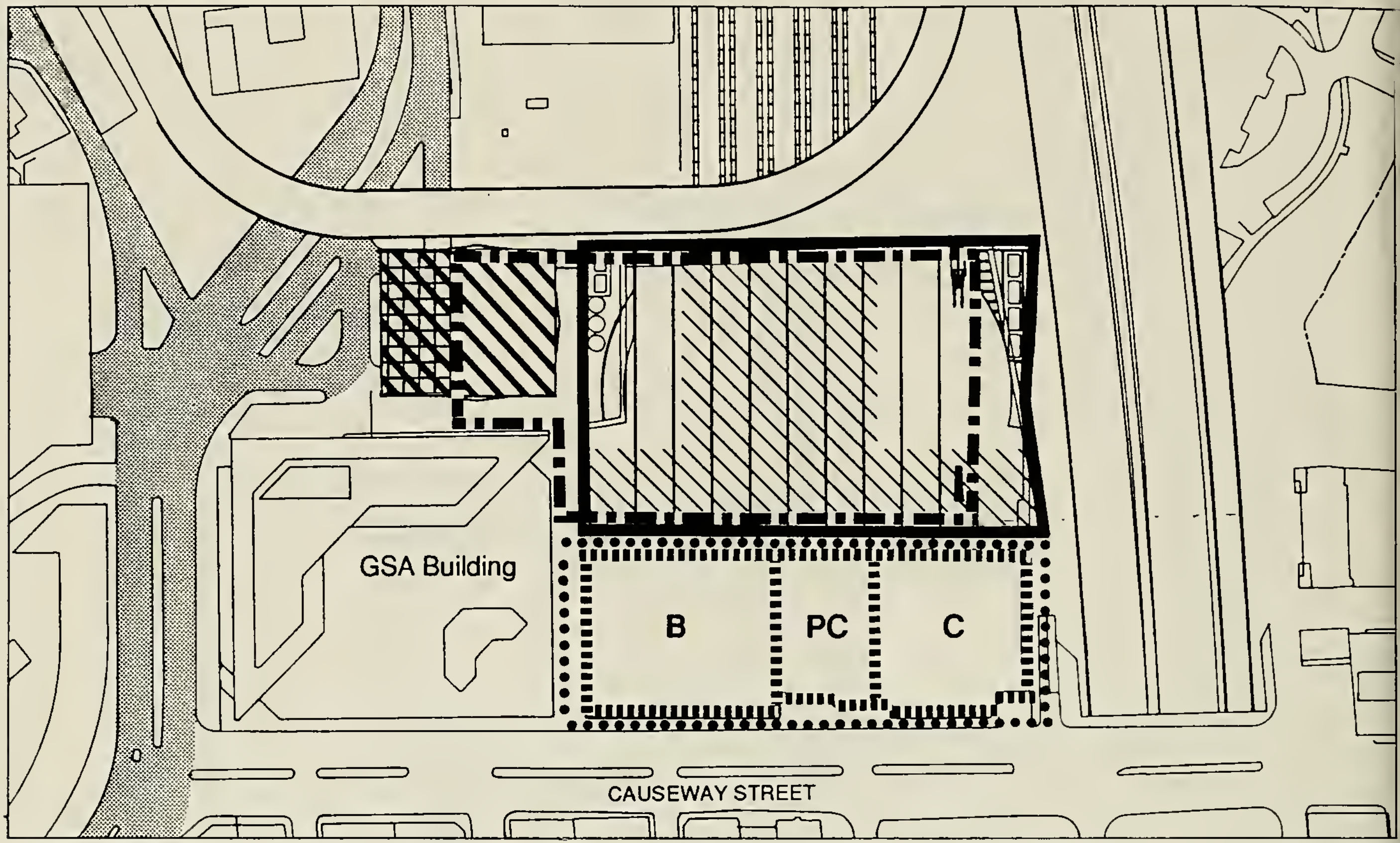
ctivities Completed in 1997	▨	Building Cladding & Interior Finishes (Building B)
	▨	Causeway Street Streetscape Improvements
	▨	Central Artery Construction Complete
ompleted Project Components	▬	New Boston Garden Arena
	••••••	Project Garage (Below Grade)
	▮▮▮▮▮▮▮	Public Concourse (PC) Building C
	▨	MBTA Commuter Rail Platform
	▬ ▪ ▬	MBTA Garage (Below Grade)

100 200 Feet

Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Construction Sequence
1997

Figure IV-N-10



Activities Completed in 1998	▦	Caissons (Building A)
	▒	Nashua Street Final Alignment Construction Begins
	▧	Steel Erection (Building A)
Completed Project Components	▬	New Boston Garden Arena
	•••••	Project Garage (Below Grade)
	▮▮▮▮▮▮▮▮	Public Concourse (PC) Building C Building B
	▨	MBTA Commuter Rail Platform
	▬ ▪ ▬	MBTA Garage (Below Grade)

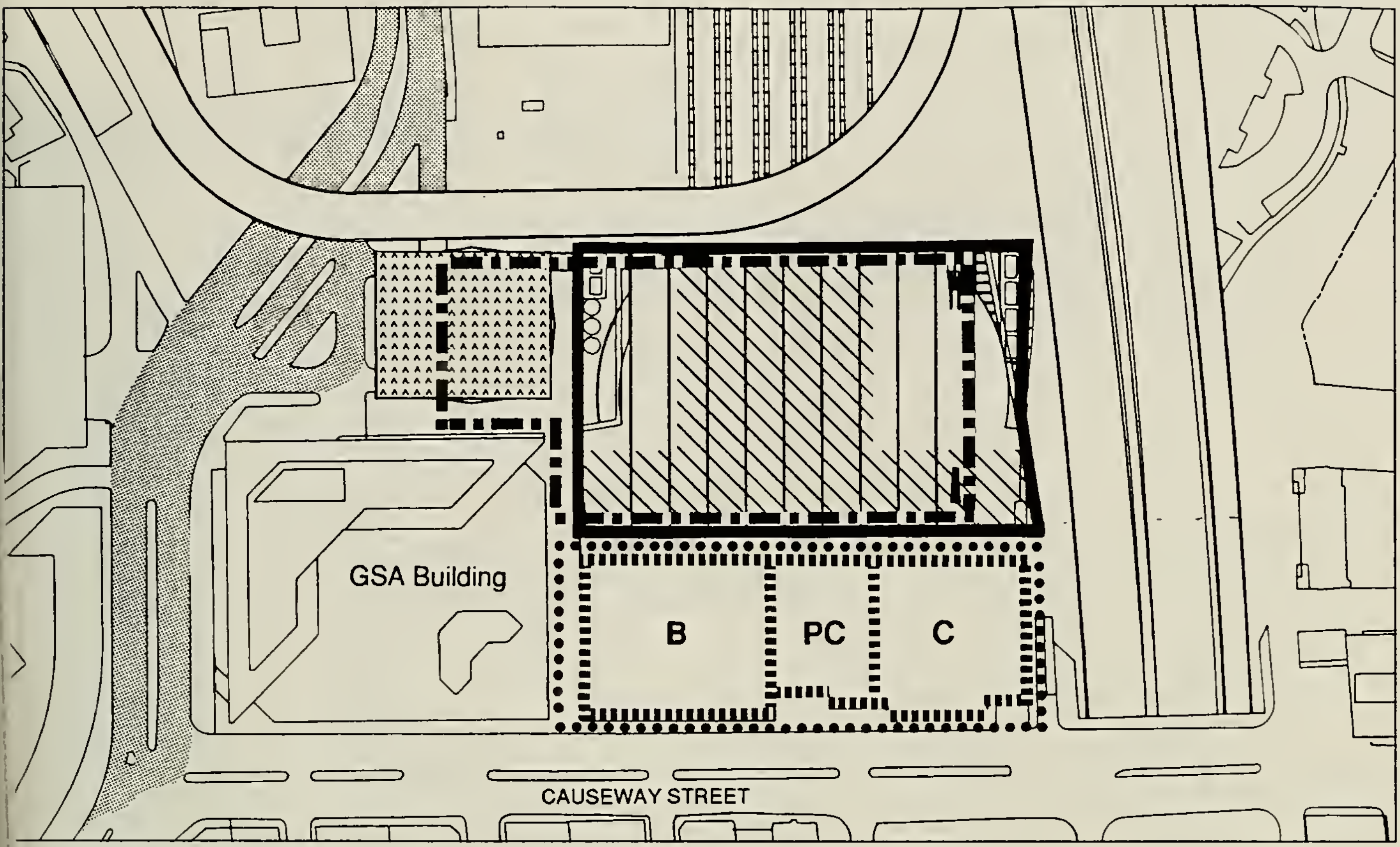
Note: Central Artery construction to east & north of site is complete.

0 100 200 Feet

Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Construction Sequence
1998

Figure IV-N-11

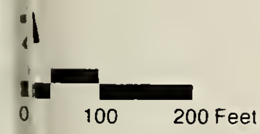


ctivities Completed in 1999

▦	Building Cladding/Interior Finishes (Building A)
▒	Nashua Street Final Alignment Construction Complete

ompleted Project Components

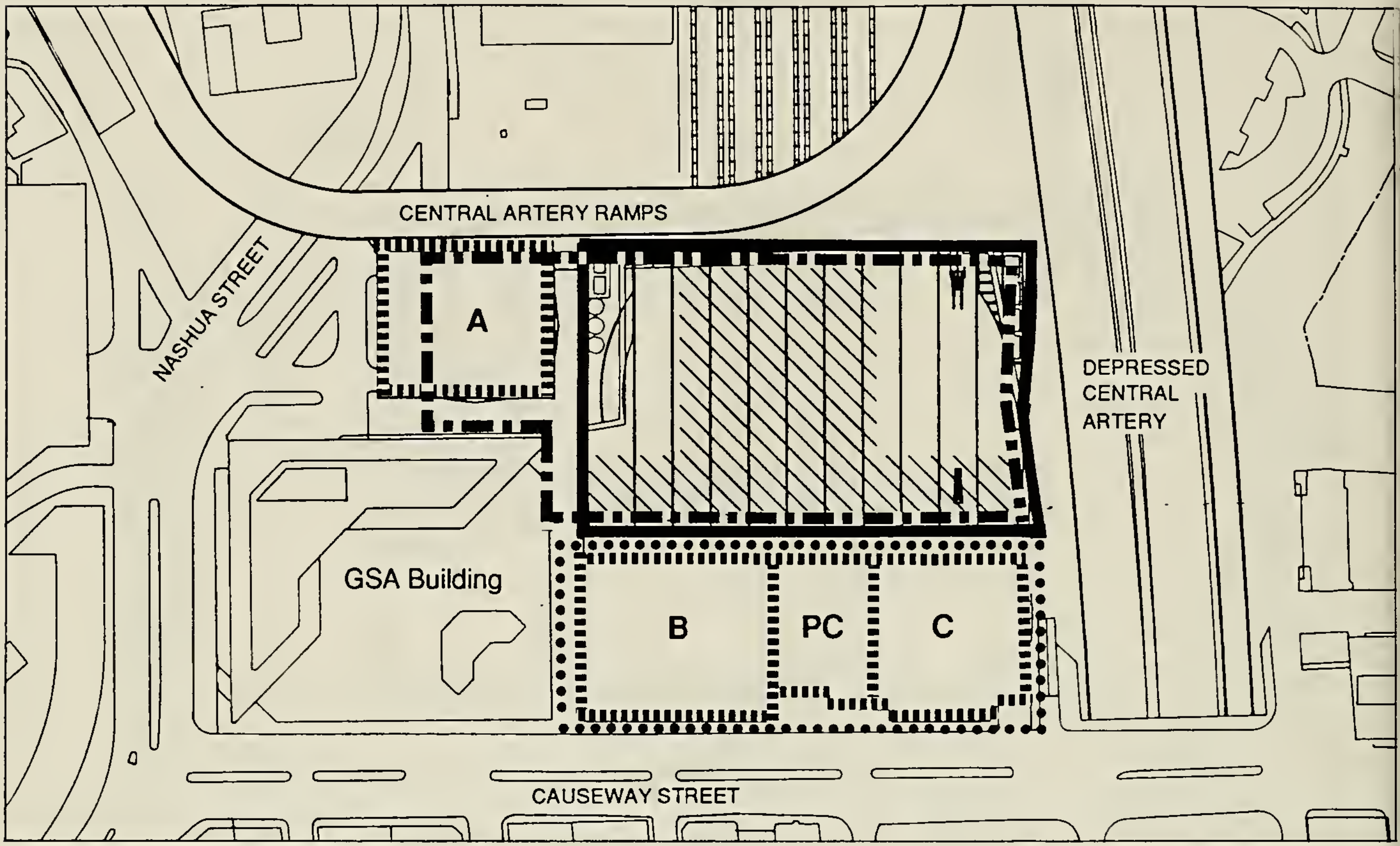
━━━	New Boston Garden Arena
•••••	Project Garage (Below Grade)
▮▮▮▮▮▮▮▮	Public Concourse Building C Building B
▧	MBTA Commuter Rail Platform
▬ ▪ ▬	MBTA Garage (Below Grade)



Vanasse Hangen Brustlin, Inc.

New Boston Garden Development
Construction Sequence
1999

Figure IV-N-12



Completed Project Components
2000

New Boston Garden Development

▬ New Boston Garden Arena (Air Rights)

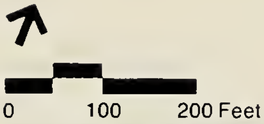
••••• Project Garage (Below Grade)

▮▮▮▮▮▮▮ Public Concourse (PC)
Building C
Building B
Building A

MBTA

▨ MBTA Commuter Rail Platforms (at Grade)

▬ ▪ ▬ MBTA Garage (Below Grade)



New Boston Garden Development
Construction Sequence
2000

Figure IV-N-13

COORDINATION WITH NEARBY TRANSPORTATION CONSTRUCTION PROJECTS

In addition to the MBTA underground garage and Green Line tunnel construction projects on-site, several other construction projects are expected to be undertaken in the vicinity of the site. The three major public projects include the depression of the Central Artery, improvements to Nashua Street, and improvements to Merrimac Street. Coordination of the New Boston Garden Development with these projects will be important to successful completion of the proposed project.

Central Artery Reconstruction

The Massachusetts Department of Public Works (MDPW) is proceeding with the depression of the Central Artery. This project is divided into two dozen sections. Three of these sections of the Central Artery project will impact construction activities on the New Boston Garden Development project site. First, the construction of the depressed section of the Central Artery between North Street and Causeway Street (Section D015A) is scheduled to commence during the fourth quarter of 1992 and to be completed by January 1999. This project includes cut-and-cover construction and temporary surface street restoration. Second, the construction of the Central Artery north of Causeway Street (Section D019B) is scheduled to commence during the first quarter of 1993 and to be completed by January 1999. This project includes the construction of the connection between the depressed Central Artery and Interstate 93 north of Boston. Finally, the third section of the Central Artery project relevant to the New Boston Garden Development will be the construction of the permanent surface artery streets. This two-year project is scheduled to be completed after the existing elevated Central Artery structure is removed.

The schedule for constructing the Central Artery sections described above is based on current information. The MDPW has made a firm commitment to maintain traffic flow through Boston at all times during construction activities. Each section design must develop a traffic management plan that maintains traffic through the city, avoids disruption to city neighborhoods, and incorporates the impacts of adjacent public and private construction projects. As a result of this MDPW commitment Central Artery construction activities and impacts should not necessarily affect the project construction activities.

Nashua Street Improvements

The MBTA, the city and the project proponent plan several stages of improvements to Nashua Street. The various stages or levels of improvements have been developed to mitigate temporary construction impacts and respond to transportation system needs, and are also necessitated by the disturbance to Nashua Street from the MBTA Green Line improvement projects. These various stages are summarized below:

- 1990 - 1992. MBTA will construct a series of roadway detours/relocations to facilitate utility relocation and site access to construction activities associated with the construction of the MBTA underground garage and Phase I Green Line tunnel construction.

- 1992 - 1994. MBTA will construct roadway improvements to provide access to the MBTA underground parking garage. These roadway improvements will consist of a Nashua Street and Lomasney Way intersection and improvements to Lomasney Way and a portion of Nashua Street.

- 1995 - 1998. Improvements to Nashua Street and Lomasney Way intersection will be constructed to accommodate transportation needs in the area. These improvements will constitute an "Interim Plan" for the intersection, and will be constructed around the elevated Green Line and existing Storrow Drive ramp foundations and columns. These improvements would be completed as part of a joint City and state initiative.

- 1998 - 2000. Final improvements to the Nashua Street and Lomasney Way intersection and Lomasney Way will be constructed. These improvements will maintain the basic transportation scheme previously labeled "Interim Plan". However, this stage of improvements will reflect the absence of the elevated Green Line and as well as the new Central Artery alignment.

Merrimac Street Connector

The City of Boston has a commitment from the MDPW for an Urban Systems project in the North Station area. This Urban Systems project includes improvements to Nashua Street, Lomasney Way, Causeway Street, and Merrimac Street. To date, the reconstruction of Nashua Street has been completed. Lomasney Way and Causeway Street Urban Systems improvements are on hold as a result of proposed construction projects in the area and their interrelation with the proposed construction of the Depressed Central Artery.

Recently, the City made a commitment to use city funds to advance these improvements to Merrimac Street. The proposed project will involve reconstruction of Merrimac Street as a divided four lane street between New Chardon Street and Lomasney Way. The cross-section of the street and streetscape improvements are planned to be an extension of Congress Street, with the extent of streetscape improvements dependent on available city funding. The Merrimac Street improvements will be planned to be compatible with existing and future street patterns in the North Station area. The city has scheduled reconstruction of Merrimac Street for 1991.

PROBABLE PROJECT IMPACTS AND MITIGATION MEASURES

The following section describes the potential short-term environmental impacts associated with the construction of the New Boston Garden Development and outlines the actions that will be taken to mitigate these impacts. The proponent will coordinate with the City of Boston, the MBTA, MDPW, GSA, MDC, BWSC, MGH, and area landowners in the construction of the New Boston Garden Development.

Construction Management

As the project plans progress and contractor(s) are selected for the New Boston Garden Development, detailed Construction Management Plan(s) will be prepared by the proponent's transportation consultant and submitted to the Boston Transportation Department. The plan will include a Traffic Maintenance Plan which addresses issues including: access to public ways and sidewalks; pedestrian access; construction schedule and hours of activity; storage of construction-related vehicles, equipment, and materials; site plans; proposed truck routes; and location of remote staging areas. The Construction Management Plan[1] will also describe measures to protect public safety as well as additional appropriate mitigation measures.

Measures to Protect Public Safety

Various measures will be implemented to protect public safety during all stages of the construction period. Public access to the commuter rail platforms will be maintained throughout the construction period. During the construction of the New Boston Garden, a protected pedestrian walkway constructed on the at-grade slab will provide public access through the existing Boston Garden, from Causeway Street, to the rail lines. In addition, other public walkways will be provided as needed, through or around the construction site. The covered pedestrian walkways will remain operational throughout the construction period of the New Boston Garden.

Other measures planned to protect public safety will include:

- Provision of safe pedestrian access by means of walkways, fences and signage.
- Erection of protective barriers around demolition and construction sites
- Provision of fire lanes and appropriate signs through and around the site
- Installation of appropriate lighting on-site and adjacent to construction areas
- Police details to manage traffic and public safety

The specific measures to protect public safety will be included in the Construction Management Plan submitted to the City for approval.

Traffic

Truck traffic will be generated by the need to remove excavate and demolition debris from the site and by delivery of building materials such as concrete, structural steel, and building facades. It is anticipated that the peak period for construction-related traffic will be associated with the excavation of the underground parking garage on the site of the existing Boston Garden. The excavation period for the project Garage is anticipated to last approximately

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1/ "City of Boston, Construction Management Program", December 1989.

nine months, beginning in the spring of 1994. Approximately 100 daily truck loads, or twelve truck loads per hour, of excavate will need to be hauled from the project site during that period. Truck volumes associated with other aspects of project construction are not yet determined. However, it is anticipated that for the remainder of the construction period, truck traffic is likely to be less than one-quarter of the level generated by excavation activities.

In order to mitigate the short-term impacts of the truck traffic, the Construction Management Plan mentioned above will provide for specific truck routes mandated by the Boston Transportation Department. Routes will be selected to minimize impacts on local streets and will make maximum use of available regional highways. In addition to measures to be taken to protect public safety, other measures to mitigate the impacts of construction will include:

- Provision of adequate storage areas for construction materials
- Encouragement of construction workers to use public transportation
- Identification and utilization of truck waiting areas
- Development of graphics and signage to direct pedestrians through and around the construction site

Traffic-related construction impacts and mitigation measures are discussed in greater detail in Chapter IV-A.

Air Quality

The construction-related air quality impacts described in this section will occur during construction of the commercial component of the project but will not occur during construction of the New Boston Garden. The primary reason there will be no air quality impacts from construction of the New Boston Garden is that the building will be erected on an at-grade concrete slab that the MBTA will have constructed, and no new excavation will be required.

During the construction of the commercial component of the New Boston Garden Development, short-term air quality effects will result from fugitive dust emissions. Construction of the New Boston Garden Development will proceed over a ten-year period in conjunction with many other public works projects. Fugitive dust emissions will occur primarily during 1993 and 1994 when demolition and excavation will take place. The existing Boston Garden will be demolished using standard mechanical techniques and equipment; no explosives or implosives will be used.

As required by the Massachusetts Department of Environmental Protection (DEP) dust will be controlled during construction and demolition as needed by water spray. Water spray provides an approximate reduction of 50 percent in dust emissions during construction and will be used in conjunction with all activities that disturb the soil above the water table line on days when the surface is dry and exposed. The spread of fugitive dust off-site will also be reduced by the "up-down" method of construction and fencing used around the perimeter to shield public areas from construction activities. Water spray will also be used during the demolition of the existing Boston Garden.

Additional temporary air quality impacts are expected to result from the exhaust of construction vehicles operating on site and from trucks traveling to and from the site. Based on estimates of the emissions during peak period of excavation and demolition, the total emissions from construction vehicles on site during the peak period will not be significant when compared to emissions from automobiles on nearby streets.

The following mitigation measures will be implemented to ensure that dust levels during construction are unobjectionable at sensitive receptor locations:

- The "up-down" method of construction and fencing used around the perimeter of construction areas to shield the public will help to contain fugitive dust.
- Fugitive dust will be controlled with water spray as needed during demolition and construction. No chemical soil stabilizers will be used.
- All trucks hauling demolition materials and excavate from the site will be covered.
- Fencing used around the perimeter of construction areas to shield the public will help contain fugitive dust.

Noise

Construction-related noise impacts will occur during construction of both the New Boston Garden and the commercial component. The principal noise generating activities include: demolition of the existing Boston Garden; excavation for the project Garage and foundation construction; steel erection and building cladding; diesel truck traffic moving to and from the site; and construction vehicles operating on site.

Demolition of the existing Boston Garden will be accomplished using standard mechanical techniques. Since explosives will not be used in the process, the noise impacts of demolition are expected to be minimal. Noise impacts from construction machinery operating on-site will be unavoidable, temporary, and variable in nature. The noise on any given day will depend on such factors as what areas are being worked, the distance to nearby sensitive receptors, and the type and quantity of equipment in use.

The greatest noise impact will likely occur from trucks visiting the site to remove excavate and demolition debris and to deliver materials. These impacts will be temporary, and will decrease substantially after excavation for the project Garage is complete. In order to mitigate the short-term impacts of the truck traffic, specific truck routes will be specified by the Boston Transportation Department through the Construction Management Plan.

As required by DEP Air Pollution Control Regulation 7.10, measures will be taken to minimize noise impacts on the surrounding community. Construction noise from the site will be managed to comply with DEP and City of Boston regulations. The following mitigation measures will be implemented:

- No pile-driving will be done on the site. Foundation work is to be slurry walls and caissons.
- No explosives will be used for demolition.
- All noise-generating equipment to be used will be inspected to ensure a noise muffler is in place and in good working condition.
- Safety fencing placed on the perimeter of the site will help to shield the community from noise. In addition, excavation is below-grade and is shielded by concrete slabs.

Geotechnical Conditions

During the excavation and slurry wall construction process, a construction monitoring program will be in place to monitor the performance of the proposed construction methods. Instruments will be installed to monitor ground movement, horizontal and vertical building movement, vibrations, water levels, pore pressures, and general performance of the earth support system.

No impacts are anticipated on adjacent structures and utilities associated with the installation of foundation elements, other than possibly drilling through pile caps of 150 Causeway Street. Drilling of these pile caps will not impact the structural integrity of 150 Causeway Street.

Project specifications will include provisions for preplanned remedial measures for the contractor to initiate prompt resolution of movements or lowering of groundwater levels if indicated by the construction monitoring program. Threshold movement and groundwater drawdown criteria will be established prior to construction.

Rodent Control

The City of Boston has declared that the infestation of rodents in the city is a serious concern. In order to control this infestation, the City has established requirements pursuant the Massachusetts Sanitary Code that commitments to implement rodent control measures will be required in connection with permits for demolition, excavation, and foundation construction. Rodent extermination certificates are required as part of the building permit process.

Presently, Boston Garden has an active Rodent Control Program which includes inspections, and monitoring (and treatments, as needed) for rats and mice. Use of rodenticides is conducted in accordance with applicable requirements of the US Environmental Protection Agency and the rodenticide manufacturers. Coverage is provided to the Boston Garden, Blades & Boards, Boston Garden's Sports Cafe, Massachusetts Sportservice concession stands, and 150 Causeway Street. A rodent control program will be developed in consultation with the City of Boston to address rodent problems associated with the construction of the commercial component. Currently, the MBTA has an extensive rodent control program in place, associated with the construction of the MBTA underground parking garage. Once the New Boston Garden is operational, efforts will be made minimize conditions which attract rodents. The existing rodent control program will be modified to address any problems that might arise.

During the excavation of the underground garage, the rodent population in the vicinity of the site could be displaced. This will be addressed through a number of measures. A rodent extermination certificate will be filed with the building permit application to the City. Rodent inspection, monitoring, and treatment will be carried out before, during, and at the completion of all demolition and foundation work for the proposed project, in compliance with City requirements. The frequency of treatment and service visits will be conducted in accordance with City guidelines. Rodent extermination prior to work start-up will consist of treatment of areas throughout the project area, including alleyways, surrounding building exteriors, and building interiors. During the construction process, regular service visits will be made in order to maintain effective rodent control levels.

CONCLUSION

The sequencing of the project and the development of acceptable mitigation plans are essential elements of the environmental evaluation of this project. Project sequencing and mitigation is complicated by the simultaneous construction of various public and private projects, some of them located on the site of the New Boston Garden Development, and thus construction sequencing and mitigation plans must be acceptable to all parties. These plans must be developed to allow for economically feasible construction of the project while at the same time achieving effective mitigation.

As part of the construction process, the contractor for the New Boston Garden will prepare a Construction Management Plan and file it with the City of Boston for approval. This plan will address site access, construction techniques, proposed on-site and off-site staging, scheduling, construction operations, and travel, and delivery of materials and personnel to the project site. Similar plans will be prepared and filed for future development stages of the New Boston Garden Development. The construction management plans will be compatible with the construction sequencing, staging, and mitigation of approved Construction Management Plans of other area building projects.

V Mitigation

INTRODUCTION

This chapter presents a summary of the mitigation measures proposed to minimize any potential adverse effects of the New Boston Garden Development. This program of mitigation measures has been defined and committed to by the proponent in order to address potential project-related effects in the impact assessment categories described throughout this document. Mitigation measures are intended to address the objectives of city and state agencies, area residents, project abutters, and business people.

The mitigation measures are listed under a generalized heading for each impact area and are described more fully in Chapter IV, Environmental Issues. The applicability of each identified mitigation measure to the various project components is denoted as follows:

- (A) Arena. These mitigation measures will be undertaken for the New Boston Garden.
- (B) Both Components. The New Boston Garden and the commercial component will each incorporate these mitigation measures independent of each other, but in a coordinated manner, as appropriate.
- (C) Commercial Component. These mitigation measures are specific to the commercial component.

TRANSPORTATION

Travel Demand Management

- Establish a transportation coordinator position (B).
- Promote the concept of ridesharing through project marketing efforts (B).
- Cooperate with the city in implementing a computerized rideshare program such as RideSource (C).
- Work with the Massachusetts Bay Transportation Authority (MBTA) to establish a public awareness program on transportation options (B).

- Establish a preferential parking program for car and vanpools for the commercial component and work with the MBTA to do the same during arena events (B).
- Require project employers to assist in the implementation of the mitigation plan (C).
- Promote usage of public transportation services (B).
- Provide information to tenants about available public transit services (C).
- Implement a transit pass subsidy program for New Boston Garden Corporation (NBGC) employees (A).
- Encourage transit pass subsidies by other employers (C).
- Sponsor a semi-annual "Transportation Awareness Day" (B).
- Promote bicycle transportation and provide secure bicycle parking (C).
- Encourage employers to implement alternative work schedules (C).
- Coordinate with other area employees in the implementation of the Transportation Demand Management (TDM) program (C).

Public Transportation

- Construct a project entrance to the new MBTA Green and Orange Lines superplatform beneath Building C (C).
- Provide convenient pedestrian access to commuter rail from the project (B).
- Advertise MBTA services at arena events (A).
- Investigate the feasibility of special trains for arena events (A).
- Coordinate with the MBTA in the promotion of public transportation (B).

Parking Management

- Apply for a temporary parking freeze exemption to allow use of the project Garage as partial replacement for Central Artery and MBTA construction-related parking losses in 1995 (C).
- Coordinate with the MBTA to integrate the project Garage with the adjacent MBTA garage and provide coordinated operation and maximum flexibility in the use of the available parking spaces (C).
- Reduce parking demand by limiting parking space commitments to tenants (C).

- Develop a parking pricing plan to encourage short-term parking or hold spaces off the market until 9:30 AM (C).
- Provide adequate parking for disabled persons (C).
- Use arena communication facilities to discourage arena patrons from parking in surrounding neighborhoods (A).

Access and Circulation Design

- Disperse vehicle activity by providing separate garage access/egress via Nashua Street and Accolon Way and by providing appropriate signage within the Garage (C).
- Continue to work with the City of Boston (Boston Transportation Department), MBTA, and Massachusetts Department of Public Works (MDPW) to develop appropriate designs for the Nashua Street-Lomasney Way Connector and for an improved Causeway Street (B).
- Separate arena bus/truck flows from garage traffic at the Accolon Way access/egress location (B).

Loading

- Work with appropriate agencies to provide off-street storage space for buses and for media-control vehicles during arena events (A).
- Disperse delivery vehicle activity by providing separated access/egress via Nashua Street and Accolon Way (B).
- Require all commercial deliveries be made to off-street underground docks (C).
- Discourage commercial deliveries during commuter peak periods (C).
- Minimize truck traffic during arena changeovers (A).
- Provide an operator management plan for arena deliveries (A).
- Provide sufficient off-street space to prevent on-street truck backing or queuing (C).
- Provide a separate truck ramp for the arena to avoid on-street truck staging (A).

Pedestrian Improvements

- Provide connections (internal to the project) to the MBTA's adjacent rapid transit and commuter rail stations (B).
- Provide a Public Concourse for pedestrian access to the arena, the commercial development, the transportation complex, and the garages (C).

- Improve pedestrian connections to the General Services Administration (GSA) Building and the Charles River area, and across Nashua Street, Lomasney Way, and Causeway Street (B).

- Create a new pedestrian arcade along the Causeway Street sidewalk at Buildings B and C (C).

- Implement a project-wide pedestrian guide-sign program (B).

- Provide pedestrian lighting on-site (B).

- Provide full accessibility to disabled persons on-site (B).

- Provide public accessibility to the entire ground floor level within the site (B).

- Coordinate with the MBTA, GSA, Metropolitan District Commission (MDC), and Massachusetts General Hospital (MGH) in the provision of pedestrian facilities (B).

Roadway and Traffic Control Improvements

- Provide funding for concept planning of the Nashua Street-Lomasney Way Connector (see Access and Circulation Design) from Causeway Street to just north of the Central Artery ramps (B).

- Contribute to the concept planning and design of Causeway Street (see Access and Circulation Design) (B).

- Contribute to the design of the Nashua Street-Lomasney Way Connector (B).

- Contribute to the construction cost of the Nashua Street-Lomasney Way project (B).

- Facilitate coordination with the Boston Public Works Department and the BTD for design work being done on the Merrimac Street and Lomasney Way improvement projects (B).

- Support the City's enforcement program of existing traffic and parking regulations in the project area by providing funding for traffic control officers for use during Boston Garden events (A).

- Causeway Street, Lomasney Way, Staniford Street, and Merrimac Street (Lowell Square) - For 1995 no mitigation is required. For 2000, prohibit parking on the Staniford and Merrimac street approaches and widen Causeway Street to provide four approach lanes. Provide protected left-turn phases, and allow concurrent pedestrian flow during through traffic phases.

- Causeway Street and Canal Street - For 1995, signalize. For 2000, reconfigure to provide the center median and one additional lane each way during peak periods; parking can remain during off-peak hours.

- Causeway Street and Accolon Way - For 1995, signalize and restrict parking on the Causeway Street westbound approach (all hours) and in the eastbound median and curb lanes (peak hours). For 2000, revise signal phasing and timing, reconfigure the intersection for center median and three lanes each way, with peak period parking restrictions.

- Causeway Street, North Washington Street, and Commercial Street (Keany Square) - For 1995, extend the afternoon parking ban on North Washington Street approach to the morning peak. For 2000, maintain peak hour parking restrictions and widen the Commercial Street approach to three lanes, while still preserving the two eastbound lanes on Commercial Street.

- Cambridge Street and Staniford Street - For 1995, no mitigation is required. For 2000, prohibit parking on the Staniford Street approach during both peaks to create dual right-turn lanes; adjust signal timing.

- Cambridge Street and New Chardon Street - Adjust signal timing in 1995 and 2000.

Construction Traffic Management

- Coordinate with BTD in the creation and implementation of a Construction Management Plan including a Traffic Maintenance Plan (B).

- Designate truck routes (B).

- Provide covered pedestrian walkways (B).

- Provide adequate on-site storage areas for construction materials. (B).

- Encourage construction workers to use public transportation (B).

- Provide truck waiting areas (B).

- Provide police officer traffic management (B).

- Develop a construction graphics program (B).

Monitoring

- Implement a transportation monitoring program in response to the Boston Transportation Department's requirements (B).

AIR QUALITY

- Traffic signal timing changes are recommended to reduce air quality impacts at the intersection of Causeway, North Washington, and Commercial streets and at City Square in Charlestown.

- Air quality modeling results suggest that future land uses adjacent to the City Square intersection be planned to provide sufficient space between the land use and the intersection to reduce the public's potential exposure to motor vehicle emissions.

- Since no adverse air quality effects are expected due to the operation of the project parking garage, even under worst case conditions, no mitigation measures specific to the garage are needed.

- The "up-down" method of construction will minimize the time that the surface of the site is open to the elements, reducing construction dust emissions (B).

- A regular program of street sweeping will minimize dust from movement of construction vehicles on city streets (B).

- All trucks hauling demolition materials and excavate from the site will be covered (C).

- Fencing used around the perimeter of construction areas to shield the public will help to contain fugitive dust (B).

- Fugitive dust will also be controlled with a water spray as needed during demolition and construction; no chemical soil stabilizers will be used (C).

NOISE

- The small increase in noise levels from project traffic are deemed insignificant and no mitigation is required for project traffic noise effects (B).

- The noise from the New Boston Garden's cooling units and the project's commercial component will comply with the Massachusetts Department of Environmental Protection's (DEP) noise regulations (B).

- The proponent will comply with DEP Air Pollution Control Regulation 7.10 and the City of Boston's noise regulations for construction activity (B).

- No pile-driving will be done on the site. Foundation work is to be slurry walls and caissons (C).

- No explosives will be used for demolition (C).

- All noise-generating equipment to be used will be inspected to ensure a noise muffler is in place and in good working condition (B).

- Safety fencing placed on the perimeter of the site will help to shield the community from noise. In addition, excavation is below-grade and is shielded by concrete slabs as part of the "up-down" construction method (B).

VISUAL QUALITY

- Continue intensive project review process with the Boston Redevelopment Authority (BRA) and other interested parties.

HISTORIC RESOURCES

- The project's design respects the adjacent historic district by utilizing massing forms that respond to the design of the buildings in the Bulfinch Triangle Historic District (C).
- Planned pedestrian arcades will provide a human-scale transition to the project site (C).
- The project is planned to respond to detailing and material elements evident in the Bulfinch Triangle district. The buildings are also intended to reflect the architectural diversity found in the adjacent historic districts (C).
- The New Boston Garden has been designed as an attractive, distinctive building which will help create a gateway view to the City of Boston (A).
- The design of the commercial component is intended to retain and enhance pedestrian flows in the area, particularly through the entrance design of the Public Concourse and the Causeway Street arcade (C).
- As part of this Draft EIR/PIR, documentation on the existing Boston Garden is being provided to the Massachusetts Historic Commission, the Massachusetts Archives, the Boston Landmarks Commission, and the New England Sports Museum.

WIND

Several remedial devices have been recommended for locations on and around the development site to assist in creating a comfortable wind environment for pedestrian activities. These devices will be designed in consultation with the BRA and the GSA.

- A canopy is being considered for installation along the Causeway Street facade of the proposed Public Concourse to reduce the amount of upper-level winds downwashed to grade level (C).
- A windscreen is proposed for the roof of the Public Concourse to reduce winds deflecting off Building C and spilling off the Public Concourse to grade level (C).
- A trellis, in conjunction with a windscreen at the north end of Accolon Way, is proposed to reduce wind velocity (A).
- To reduce the impact of easterly wind flows deflecting off the east facade of the New Boston Garden and Building C, a pennant on the east face of Building C, in conjunction with windscreens along the east side of Accolon Way, is proposed. Similarly, pennants along the south facade of Building C are suggested to mitigate winds on Causeway Street (C).
- A combination of windscreens 45 feet high located in the proposed passageway between the New Boston Garden and the GSA Building and between Building A and the GSA Building would provide mitigation for dangerous wind conditions at these locations (B).

SHADOW

- Siting of the development relative to residential, commercial, and open space areas to the south minimizes shadow impacts of the project (B).
- Building heights are varied to limit the potential impact from close, densely massed buildings (C).
- Buildings A, B, and C have been designed to maximize sunlight conditions for pedestrian areas for midday and afternoon periods through the introduction of setbacks in the forms of the structures (C).
- All building setbacks as required by zoning have been observed (C).

DAYLIGHTING

- Setting back the tower elements of Buildings B and C from the front of their base structures (55 feet for Building B, and 23 feet for Building C) will result in little obstruction of daylight from pedestrian viewpoints (C).
- The height of the Public Concourse has been designed to be 55 feet (C).
- The arena's 191-foot setback from the Causeway Street facade of the development limits the impact of the project on daylight conditions (A).

INFRASTRUCTURE

Storm Drainage and Sanitary Sewers

- A new drainage system will be built, featuring a new 42-inch drain line to collect virtually all site runoff and discharge it to the Charles River. Currently, this site runoff drains to combined sewers. As a result of this project, the incidence and volume of combined sewer overflows will be reduced (A).
- The project proponent will provide for the construction and future maintenance of the storm drainage system for the portion of the site owned by NBGC as well as those areas owned by the MBTA and MDPW, eliminating significant construction and maintenance costs which would otherwise be borne by public agencies (A).
- Construction of the New Boston Garden Development will substantially reduce infiltration and inflow problems in the area's combined sewers by removing a volume of stormwater from the system that far exceeds the amount of new sewage (B).
- The proponent will coordinate with the Boston Water and Sewer Commission (BWSC), Massachusetts Water Resources Authority (MWRA), MDC, MDPW, and the MBTA in the design and construction of new storm drainage facilities and sanitary sewers (B).

Water

- The New Boston Garden is designed to minimize water use through the use of water conserving fixtures (A).
- To minimize the New Boston Garden's water demand, the mechanical system design will utilize air economizers in lieu of cooling towers during the spring and fall seasons to provide air conditioning (A).
- Water conservation measures will be incorporated in the design of the commercial component as each building is designed (C).
- The proponents will coordinate with the BWSC and the MBTA in the design and construction of new water connections so as to minimize short-term construction-related disruptions in service.

Energy

In the area of energy conservation, the New Boston Garden Development will feature:

- Use of energy-efficient motors and transformers (A).
- Use of high-intensity discharge (HID) lighting which has a lower electric demand than conventional lighting (A).
- Use of computerized lighting control which will automatically shut down lighting systems when their use is not required (A).
- Energy-efficient lamps and ballast (A).
- White reflective insulated roof with an R value of 15.5 (A).
- A low percentage of window-to-wall area (3 percent) (A).
- An R value of insulation on walls typically in excess of 13.5 (A).
- Transition areas between the interior and exterior which will serve as "air locks" (A).
- Energy conservation measures will be incorporated into the commercial component as it is designed (C).
- The proponent will coordinate with Boston Edison and Boston Gas in the provision of service to the development and to minimize construction-related disruptions to local area service (B).

WATER QUALITY

- The reduction of inflow to combined sewers and the consequent reduction in the frequency and volume of combined sewer overflows represents the most significant measure to improve water quality in the project area (A).

- A new oil/water separator will be constructed to improve the quality of stormwater prior to discharge to the Charles River (A).
- Catchbasins to be installed as part of the project drainage system will conform to MDC standards, including sump areas to collect heavier sediments with absorbed oil and other contaminants (A).
- Storm drains and catchbasins will be maintained by the proponent (B).

SOLID AND HAZARDOUS WASTE

- Demolition debris will be removed and disposed of in such a way as to insure proper handling of potentially contaminated materials. Efforts are currently underway to identify the presence of these materials on the site (C).
- Demolition debris will be disposed of in suitable locations, and a site(s) will be selected in consultation with DEP and the City of Boston (C).
- An asbestos removal program will be undertaken in accordance with applicable state and federal regulations by a certified asbestos handling contractor prior to initiating general demolition of the building (C).
- All transformers identified as containing PCBs will be disposed of in accordance with regulations governing PCBs. Non-PCB transformers will be disposed of through scrap metal or other suitable recycling companies in accordance with applicable requirements (C).
- For the existing arena, both the primary refrigeration system used to create the ice for the ice rink and the secondary cooling loop will be serviced and decommissed by qualified contractors specializing in these types of systems in accordance with applicable requirements (C).
- Hydraulic fluids will be drained and removed from the site in accordance with applicable requirements prior to general demolition of site (C).
- Excavated soils will be disposed of in accordance with applicable requirements at a site selected on the basis of information generated by the proponent's geotechnical consultant (C).
- The New Boston Garden's solid waste will be handled with a 42 cubic yard dumpster equipped with a compactor (A). Trash removal for the arena and the project's commercial component will continue to be handled by an independent licensed contractor (B).
- Recycling measures, in addition to any required by applicable laws and regulations, will be implemented to the extent feasible (B).

GEOTECHNICAL

- The foundation elements for the New Boston Garden are being constructed by the MBTA as part of its underground garage project (A).

- Slurry wall foundation techniques will be utilized during construction to maintain existing groundwater levels and avoid damage due to compressible soils or rotting of timber piles (C).

- An "up-down" construction technique which expedites construction and limits the impacts of subsurface work will be utilized (C).

- A construction monitoring program using geotechnical instrumentation and optical survey will be used to monitor building and ground movement and groundwater levels both during and after construction. A program of rapid response measures will be developed to be used if needed (C).

- An underslab drainage system will be installed to prevent build-up of hydrostatic pressure on the bottom at the lowest level slab in the project Garage (C).

The proponent will coordinate with the MBTA, GSA, BWSC, area landowners, and the City of Boston in the implementation of the technical monitoring program (C).

CONSTRUCTION

- The proponent will coordinate with the City of Boston, MBTA, MDPW, GSA, MDC, BWSC, MGH, and landowners in the construction of the New Boston Garden Development (B).

- A detailed Construction Management Plan which includes a Traffic Maintenance Plan and measures to protect public safety will be submitted to the Boston Transportation Department (B).

- During the construction of the New Boston Garden, a protected pedestrian walkway constructed on the at-grade slab will provide public access, through the existing Boston Garden, from Causeway Street to the commuter rail lines (A).

- Safe pedestrian access by means of walkways, fences, and signage will be provided (B).

- Protective barriers around demolition and construction sites will be created (B).

- Fire lanes and appropriate signs through and around the site will be provided (B).

- Appropriate lighting on-site and adjacent to construction areas will be installed (B).

- Construction materials and equipment will be stored appropriately (B).

- Street cleaning and snow removal will occur as required (B).

- Police details will be employed to manage traffic and ensure public safety (B).

- Specific truck routes will be identified to minimize impact on local streets (B).

- Construction workers will be encouraged to use public transportation (B).

- Truck waiting areas will be identified and utilized (B).

- Graphics and signage to direct pedestrians through and around the construction site will be developed (B).

- Air quality effects of the construction of the New Boston Garden will be minimal, since the building will be erected on an at-grade concrete slab that the MBTA will have constructed, and no new excavation will be required (A).

- Dust will be controlled during construction and demolition as needed by water spray (C).

- The "up-down" method of construction and fencing used around the perimeter of construction areas will be used to shield the public and will help to contain fugitive dust (C).

- Fugitive dust will be controlled with a water spray as needed during demolition and construction. No chemical soil stabilizers will be used (C).

- All trucks hauling demolition materials and excavation from the site will be covered.

- Fencing used around the perimeter of construction areas to shield the public will help contain fugitive dust.

- To minimize noise, no pile-driving will be done on the site. Foundation work is to be slurry walls and caissons (C).

- No explosives will be used for demolition (C).

- All noise-generating equipment to be used will be inspected to ensure a noise muffler is in place and in good working condition (B).

- Safety fencing placed on the perimeter of the site will help to shield the community from noise. In addition, excavation is below-grade and is shielded by concrete slabs (B).

- A construction monitoring program using geotechnical instrumentation and optical survey will be used to monitor building and ground movement and groundwater levels (C).

- A rodent control program will be developed in consultation with the City of Boston to address rodent problems associated with construction of the commercial component (C).

VI Reviewers

INTRODUCTION

This Draft Environmental Impact Report/Project Impact Report is being distributed to the city, state and Federal agencies, and interested parties listed below. This list includes: those entities that MEPA regulations require as part of the legal review of the document; representatives of governmental agencies; and individuals who have commented on the project since the filing of the Environmental Notification Form and Project Notification Form. Additional copies of this Draft EIR/PIR are available from Don Berry, Goodwin Procter & Hoar, Exchange Place, Boston, MA 02109-2881, (617) 570-1000.

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VII

MEPA AND BRA CORRESPONDENCE

This chapter contains copies of correspondence received in response to the Environmental Notification Form (ENF) and Project Notification Form (PNF) filed for the New Boston Garden Development. It also includes the Massachusetts Environmental Policy Act (MEPA) Unit and the Boston Redevelopment Authority (BRA) scoping determinations for the project and clarifications of the scopes. These materials are presented in this chapter in the following sequence:

- Certificate of the Secretary of Environmental Affairs on the Environmental Notification Form (September 8, 1989)
- Boston Redevelopment Authority Scoping Determination - New Boston Garden Development (August 18, 1989)
- Comments filed with the MEPA Unit in response to the ENF:
    - Metropolitan Area Planning Council (May 10, 1989)
    - Boston Department of the Environment (May 17, 1898)
    - Boston Water and Sewer Commission (May 17, 1989)
    - Department of Environmental Quality Engineering, Metropolitan Boston - Northeast Region, Division of Solid Waste Management (May 17, 1989)
    - Metropolitan District Commission (May 17, 1989)
    - Department of Environmental Quality Engineering, Division of Wetlands and Waterways Regulation (May 18, 1989)
    - Executive Office of Transportation and Construction (May 18, 1989)
    - Massachusetts Historical Commission (May 24, 1989)
    - Boston Redevelopment Authority (June 1, 1989)
    - Stephen H. Kaiser (June 6, 1989)

- Comments filed with the BRA in response to the PNF:
    - -- Downtown North Association (May 18, 1989)
    - -- Masterman, Culbert & Tully, for Massachusetts General Hospital and Spaulding Rehabilitation Hospital (May 18, 1989)
- Letter to BRA re: Clarification of BRA Scoping Determination for Air Quality (October 13, 1989)
- Letter to DEP, Division of Wetlands and Waterways Regulation re: Clarification of Letter (March 12, 1990)
- DEP, Division of Wetlands and Waterways Regulation Response to Letter re: Clarification (May 31, 1990)
- Letter to BRA re: Clarification of BRA Scoping Determination (September 25, 1990)
- Letter to MEPA Unit re: Clarification of BRA Scoping Determination (September 26, 1990)
- Letter to DEP, Division of Wetlands and Waterways Regulation re: Clarification of Letter (September 26, 1990)
- MEPA Unit Response to Letter re: Clarifications (September 28, 1990)
- BRA Response to Letter re: Clarifications (October 1, 1990)

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

MICHAEL S. DUKAKIS
GOVERNOR

JOHN DeVILLARS
SECRETARY

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME : New Boston Garden Development
PROJECT LOCATION : Boston
EOEA NUMBER : 7701
PROJECT PROPONENT : New Boston Garden Corporation
DATE NOTICED IN MONITOR : April 27, 1989

Pursuant to the Massachusetts Environmental Policy Act (G.L.,c.30,s.61-62H) and Sections 11.04 and 11.06 of the MEPA regulations (301 CMR 11.00), I hereby determine that the above project requires the preparation of an Environmental Impact Report.

The scope for the required EIR shall be the Final Scoping Determination issued by the Boston Redevelopment Authority pursuant to Section 31 of the Boston Zoning Code with the following exceptions.

The traffic analysis section shall follow the EOEA/EOTC Guidelines except where specifically directed otherwise by the BRA Scope.

The EIR shall contain a discussion of the requirements for licensing pursuant to Chapter 91. This discussion shall include a clear definition of the areas subject to C. 91 and a thorough discussion of the requirements to be met and all design considerations offered to meet the requirements of Chapter 91.

September 8, 1989
DATE

JOHN DeVILLARS, SECRETARY

JD/rf

BOSTON
REDEVELOPMENT
AUTHORITY

Raymond L. Flynn
Mayor

tephen Coyle
irector

ne City Hall Square
oston, MA 02201
17) 722-4300

August 18, 1989

Mr. Lawrence C. Moulter
Chairman/President
New Boston Garden Corporation
150 Causeway Street
Boston, MA 02114

Dear Mr. Moulter:

Re: New Boston Garden Development

Enclosed is the Scoping Determination for the New Boston Garden Development (the "Proposed Project"), for which you recently submitted a Project Notification Form ("PNF") pursuant to Article 31 of the Boston Zoning Code ("the Code"). This Scoping Determination requests information that the Boston Redevelopment Authority ("BRA") requires in response to the PNF which you submitted April 24, 1989.

The BRA may require additional information during the course of our review of the Proposed Project. If you have any questions concerning the Scoping Determination or otherwise in connection with review of the Proposed Project, please contact Eric Schmidt at 722-4300.

Sincerely,

Stephen Coyle

Enclosure

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BOSTON REDEVELOPMENT AUTHORITY

SCOPING DETERMINATION
NEW BOSTON GARDEN DEVELOPMENT

PROJECT DESCRIPTION

PROJECT NAME:	New Boston Garden Development
PROJECT LOCATION:	120-150 Causeway Street (?)
APPLICANT:	New Boston Garden Corporation
PROJECT NOTIFICATION:	April 24, 1989

The Boston Redevelopment Authority ("BRA") is issuing this Scoping Determination pursuant to Section 31-5 of the Boston Zoning Code (the "Code"), in response to a Project Notification Form ("PNF") which the Proponent filed April 24, 1989. The Scoping Determination requests information that the BRA requires for its review of the Proposed Project in connection with the following:

(a) Development Review pursuant to Article 31 of the Code;

(b) Approval of a Development Impact Project Plan, pursuant to Article 26A of the Code, and the entering of agreements for the Development Impact Project Contribution and Jobs Contribution Grant, pursuant to Articles 26A and 26B of the Code; and

(c) Approval of a Development Plan pursuant to Section 39-9 of the Code in conformity with the procedures set forth in Section 3-1A.a and 39-11, and the provisions of Section 39-10 of the Code.

PREAMBLE

The BRA is reviewing the Proposed Project pursuant to multiple sections of the Code. The Proposed Project is being reviewed pursuant to Article 31 of the Code, Development Review Requirements, which sets out a comprehensive procedure for project review and requires the BRA to review the project's impacts in the following areas: transportation, environmental protection, urban design, historic resources, and infrastructure systems. Article 31 requires the submission of a satisfactory Final Project Impact Report prior to the issuance of a building permit.

The Proposed Project is located within the North Station Economic Development Area ("North Station EDA"), an area in which Planned Development Areas ("PDAs") are permitted. The Proposed Project will be reviewed pursuant to Sections 39-10 and 39-11, which establish review procedures and requirements for PDAs. since the Applicant proposes the construction of an arena (see below).

The review of the Proposed Project will be limited to any and all elements proposed by the New Boston Garden Development and/or other elements which are constructed by others specifically for development of the Proposed Project. However, analysis and mitigation studies will be limited to the proposed project as outlined in the PNF filed on April 7, 1989 by New Boston Garden Development Corporation. The Applicant is not responsible for providing information or analysis or impacts which may be caused by other on-site construction projects such as MBTA Green Line, Orange Line and the MBTA North Station Transportation Improvement projects construction as well as the State DPW Central Artery reconstruction.

I. NEW BOSTON GARDEN DEVELOPMENT PROPOSED PROJECT DESCRIPTION

According to the PNF filed on April 24, 1989, the Proposed Project, located on a 6.57 acre site in the North Station Economic Development Area the "North Station EDA", is generally bounded by Causeway Street, Nashua Street, Accolon Way, and the Central Artery Ramps. The Proposed Project includes the creation of a multi-purpose sports arena, a mass transit station, and three commercial buildings including office, hotel, retail and below-grade parking uses. Uses presently occupying the site include a sports arena, related retail, a mass transit facility, office, and surface parking. The PNF filed on April 7, 1989, sets forth the allowable development program, and the funds which the city will receive for the use of its air-rights.

As described in the PNF, the characteristics of the Proposed Project include:

Component	Use	Height	Size
Arena - MBTA Air Rights	Spectator Events	175 Feet	19,500 Seats - Floor Events 18,400 Seats - Basketball 17,200 Seats - Hockey 105 Boxes (seats included in above totals)
Building A - Nashua St.	Office and/or Hotel	375 Feet	790,000 Gross Square Feet*
Building B - Causeway St.	Hotel or Office	350 Feet	630,000 Gross Square Feet*
Building C - Causeway St.	Office	400 Feet	832,000 Gross Square Feet
Pedestal - Causeway St.	Ancillary Office and Retail	N/A	50,000 Gross Square Feet
Below-Grade	Parking	5 Levels	1,100 Spaces

* Up to 56,000 gross square feet may be shifted from Building A to Building B.

II. THE NORTH STATION ECONOMIC DEVELOPMENT AREA PLAN AND ARTICLE 39 OF THE CODE

Through its approval of Article 39 of the Boston Zoning Code on June 29, 1989, the BRA adopted the North Station Economic Development Area Plan ("Plan") as the portion of the general plan for the city governing the North Station EDA. The Zoning Commission will be considering this Article for adoption on August 23, 1989. If approved by the Zoning Commission and by the Mayor, Article 39 of the Code will establish the legal framework for the realization of the Plan. Pursuant to Article 39, the Proposed Project is located in the North Station EDA.

The Plan was developed to create a gateway to the city by rail and highway from the north, and to direct downtown development in a way that promotes balanced growth for Boston, and to facilitate the redevelopment of an aging facility which is critical to Boston's sport fans, commuters, and citizens in general.

The primary purposes of the North Station EDA zoning are:

- to direct downtown development in a way that promotes balanced growth for Boston;
- to channel growth away from congested areas and towards underutilized sites;
- to create a gateway to the city by rail and highway from the north;
- to create a mixed-use district which includes office, retail, research and development, biomedical, institutional, residential, sports facility and entertainment uses;
- to provide an area within the downtown to enhance the expansion of Boston's biomedical and research and development sectors;
- to create a complex of facilities and services which will foster economic growth in Boston and throughout the region;
- to increase the number of jobs in those sectors of the economy likely to employ Boston residents;
- to promote the creation and incubation of new research and development-intensive businesses;
- to permit a controlled mix of research and development uses along with facilities supportive of these uses;
- to create a functionally and architecturally unified district which is compatible with the North End and Bulfinch Triangle;
- to create vistas and access to the Charles River; and
- to create new recreational space along the Charles River.

Planned Development Areas

Article 39 establishes areas in which PDAs are permitted in order to encourage large-scale private development on underutilized sites. A PDA designation may be granted only if a Proposed Project in a PDA includes at least one of the following: diversification and expansion of Boston's economy in biomedical and research activities; construction of major, unique civic facilities; or creation or retention of job opportunities.

Pursuant to Section 39-6 of the Code, the Proposed Project is located within an area in which the establishment of PDAs is permitted. Specifically, the Proposed Project is located within the New Boston Garden Development Area in which an Proposed Project is allowed an as-of-right building height of four-hundred (400) feet and an as-of-right FAR of eleven (11).

Construction of Major, Unique Civic Facilities

The BRA may approve a development plan as meeting the standards for approval if the development plan proposes a plan for development consistent with the goals and objectives of the North Station EDA Plan, and if the development plan includes construction of major, unique civic facilities. If the development plan includes construction of major, unique civic facilities, the BRA may approve such a development plan only if the Proposed Project includes an indoor sports and entertainment facility and if the Proposed Project is coordinated with North Station as the major transportation gateway to downtown Boston by rail, auto, and public transportation from the north.

The applicant has proposed to construct a new Boston Garden Arena complex that will provide an arena area with a larger seating capacity than exists today (hockey-17,200; basketball-18,400; floor events-19,500). This arena will be the first phased of a multi-phased mixed-use development of hotel and commercial uses. The new arena will be open and functioning prior to the demolition of the existing structure.

The proposed arena is an acceptable submission under this standard, subject to compliance with the requirements outlined in this Scoping Determination. The new civic facility must be constructed of high quality materials and "state of the art" planning and design functions. The completed arena must be of a civic quality in its architectural design that it becomes the new symbol for public "gathering places" in Boston.

Day Care Facilities

The continuing movement of women into the workforce has resulted in a growing need for safe, affordable day care outside the family home. Article 39 requires that a Proposed Project over one million square feet either devote at least 12,000 square feet to day care facilities on-site or to create or cause to be created such facilities off-site within the North Station EDA, the Bulfinch Triangle District, or the North End. However, at least 4,000 square feet must be provided on-site. The DPIR must specify the location and program for day care for the Proposed

Project in accordance with Section 38.12.1. The Proposed Project must also specify the phasing of the day care in conjunction with the project phasing.

North Station Urban Renewal Plan

The North Station Urban Renewal Plan provided a planning framework which allowed for construction of portions of the original North Station mixed-use development. The proposed zoning will allow for the redevelopment of this most important public asset by setting guidelines which will ensure that the future North Station Development is as vital to Boston as the original development. In the future, portions of the North Station Urban Renewal Plan will be modified to be consistent with this Scoping Determination.

Use Regulations

Uses which are Allowed and/or Conditional within the North Station EDA are described in Section 39-12 of the code. The uses proposed in the PNF which include, commercial, hotel, parking and an arena are allowed. Parking is a conditional use, unless part of an approved Planned Development or a Planned Development Area.

III. DEVELOPMENT REVIEW REQUIREMENTS - ARTICLE 31

Article 31 of the Code provides a process by which the BRA reviews large scale development projects. As previously stated, the BRA is issuing this Scoping Determination pursuant to Section 31-5. The DPIR must include an analysis of the Proposed Project as described in the PNF and shall study certain aspects of options described below. The Option 2 analysis should be conducted to determine whether adjustments to the project's bulk and massing result in any significant impacts or benefits, as compared with the project as proposed in Option 1. Studies of massing alternatives should comprise urban design and environmental analyses as well as sensitivity analyses, which qualitatively address all DPIR environmental, urban design and infrastructure topics. Sensitivity analyses should indicate whether any specific massing configurations warrant detailed quantitative analysis in the Final PIR. The analyses must assess project impacts with existing Central Artery conditions and with the reconstructed Artery as documented by the Commonwealth's Department of Public Works 1989 FSEIS and any later documents or amendments to the FSEIS.

The options are as follows:

1. The Proposed Project with the hotel component in Tower A along New Nashua Street and with the square foot requirements set forth in the PNF.

2. The Proposed Project with the hotel component at tower B along Causeway Street and with the square foot requirements set forth in the PNF.

Information is required for both options.

A. GENERAL INFORMATION

1. Applicant Information

a. Development Team

(1) Names

(a) Developer (including description of development entity)

(b) Attorney

(c) Project Consultants

(2) Business Address and telephone for each

(3) Designated contact for each

(4) Description of current or formerly-owned developments in Boston

b. Legal Information

(1) Legal judgments or actions pending concerning the proposed project

(2) History of tax arrears on property owned in Boston by the developer

(3) Legal description of the parcel to be developed and evidence of a process by which the proponent will gain site control over the necessary project area prior to construction. The document must include current ownership and purchase options of all parcels in the proposed project, all restrictive covenants and contractual restrictions affecting the proponent's right of ability to accomplish the proposed project, including any third party agreement with the Massachusetts Bay Transit Authority ("MBTA").

2. Financial Information

(See Appendix 1 for required financial information)

Development and Operating Pro Formas for all components of the project (commercial, hotel, parking and arena) shall be provided. A sensitivity analysis revealing the financial performance of Option 2 relative to Option 1 is also required in the DPIR.

a. Full disclosure of names and addresses of all financially involved participants and bank references

b. Development Pro Forma for all components of the project uses

   c. Ten Year Operating Pro Forma for all components of the project

3. Project Area

   a. Description of metes and bounds of project area including all land or easements owned or required for completion of said project

4. Public Benefits

   a. Development Impact Project Contribution and Jobs Contribution Grant specifying amount of housing linkage and jobs linkage contributions and method of housing linkage contribution (housing payment or housing creation)

   b. Increase in tax revenues, specifying existing and estimated future annual property taxes

   c. Anticipated employment levels including the following:

      (1) Estimated number of construction jobs

      (2) Estimated number of permanent jobs

   d. Submission of Boston Residents Construction Plan in accordance with the Boston Jobs Policy requiring that 50, 25, and 10 percent of person-hours in construction jobs on publicly-assisted or large-scale private commercial projects be worked by Boston residents, minorities and women

   e. Submission of voluntary Employment Opportunity Plan presenting good-faith efforts to achieve the goal that the profile of permanent employees in the building be 50 percent Boston residents

   f. Description and location of day care facilities. An amount equal to at least 12,000 square feet must be provided either on-site or within the North Station EDA, the Bulfinch Triangle District, or the North End, provided that at least 4,000 square feet is on-site.

   g. Description of benefits specific to the arena use which accrue as a result of the construction of the Proposed Project

5. Regulatory Controls and Permits

   a. Existing zoning requirements, zoning computation forms, and any anticipated requests for zoning relief, the provisions of which govern the site

   b. Anticipated permits required from other local, state, and federal entities with a proposed application schedule

c. The proposed project is subject to the Massachusetts Environmental Policy Act (MEPA), submission of required documentation including copies of the Environmental Notification Form and a statement as to whether the applicant will coordinate the submission of materials required by MEPA with the submission of materials required by this scope

6. Community Groups

a. Names and addresses of project area owners, displacees, abutters, and also any community groups which, in the opinion of the applicant, may be substantially interested in or affected by the proposed project

b. A list of meetings proposed and held with interested parties as well as the commitment to a review process and schedule which will engage each of the abutting neighborhoods as requested by the abutters

B. TRANSPORTATION COMPONENT

The following requirements incorporate comments by the Boston Transportation Department ("BTD") regarding transportation issues and objectives for the New Boston Garden Development. These comments include comments of abutters to the project including Downtown North Association, Massachusetts Historic Commission and Spaulding Rehabilitation Hospital.

The following must be submitted for Option 1, including any and/or all of the alternatives. A qualitative analysis and assessment of all impacts or benefits of Option 2 will be considered.

1. Vehicular Traffic

All information regarding vehicular traffic must be submitted for the above options. In addition, the information presented in this section must be submitted for the following alternatives:

A.	1989:	Existing site condition Existing Central Artery layout
B.	Partial Build Year 1993/1995:	Existing arena and site Existing Central Artery layout (with Third Harbor Tunnel)
C.	Partial Build Year 1993/1995:	Partial build of site (arena with or without building C Central Artery layout (with Third Harbor Tunnel)
D.	1999:	No-build of project Central Artery Layout

E. 1999: Full-build of project
Central Artery Layout

a. Analyses of the existing conditions at the following intersections:

- Leverett Circle
- New Nashua Street / Martha Way / Lomasney Way
- Staniford Street / Merrimac Street / Causeway Street
- Causeway Street / Canal Street
- Causeway Street/ New Accolon Way
- Causeway Street / Commercial Street / North Washington Street
- Cambridge Street / Staniford Street
- Cambridge Street / New Chardon Street
- New Chardon Street / Merrimac Street
- New Chardon Street / North Washington Street / Blackstone Street
- Sudbury Street / Congress Street
- Sudbury Street / Blackstone Street
- City Square

Intersection analysis in the future condition must reflect any changes in roadway alignment and configuration resulting from the MDPW Central Artery reconstruction.

b. Background development and transportation projects. Due to the complex and significant nature of the roadway network changes contemplated for this area, information regarding background development and transportation projects should incorporate the findings of the State's Central Artery Team along with a list of individual background projects determined in consultation with the BRA.

c. An analysis of the impact of the Proposed Project as follows:

(1) Projection of vehicular trip generation (including automobiles, taxis, trucks, service vehicles and buses) for daily a.m and p.m. peak hours. Projections should also be conducted for a weekday arena event during the period representing peak design conditions.

(2) Trip distribution

(3) Modal split and vehicle occupancy analysis differentiating between those for arena events and those not for arena events

(4) Site Access (volumes at the Proposed Project's driveways)

d. Levels of service at the above mentioned intersections under each of the scenarios outlined in B.1.

2. Parking

   a. Existing parking conditions in the study area

      (1) Parking Characteristics in proximity to the site

      (2) The supply of parking, both on and off street

   b. Number of spaces proposed, indicating public and private allocation

   c. The Proposed Project's impact on demand for parking during peak daytime, evening and weekend or event periods as well as the level of utilization of spaces by different user types, and the degree to which joint use of spaces can result in lower parking space demand

   d. A parking plan, including layout, access, size of spaces

   e. Based on the assumption that the Proposed Project's parking facility will be located adjacent to a parking facility proposed by the MBTA, information should be provided to clarify the degree to which the garages will function in a coordinated manner, including but not limited to the degree to which those persons destined for the Proposed Project will use the MBTA garage, and vice-versa.

   f. Information regarding rate structures and parking operations management

   g. Location of and demand for bus storage

3. Loading

   a. Number of docks

   b. The location and dimension of docks

   c. Estimated size and types of vehicles serving the site and particularly the arena, and the ability of the proposed loading docks to accommodate those vehicles

   d. Analysis of one-way versus two-way access roadway for trucks along Accolon Way

4. Access

   a. Size and maneuvering space for all vehicles on site or in public right-of-way; and the internal maneuvering space for trucks of all sizes, especially with regard to the disruption of on-street traffic flow by trucks backing in or out. Analysis of potential pedestrian-vehicular conflicts must be presented in the DPIR. Information required in this section should be provided at a minimum in plan form showing any and all levels accessible by vehicle.

b. Access, curb cuts, and/or sidewalk changes required with specific references to vehicular volumes at each driveway accessing the site

c. Analyses of access to loading docks under various event and non-event time periods

5. Public Transportation

a. Location and availability of existing public transportation facilities

b. Usage, capacity, and planned improvements to the existing system

c. Demand and capacity analysis for peak hours and for periods of peak arena trip generation

6. Pedestrian Circulation

a. Existing and proposed for both Options A and B pedestrian conditions in the study area and on-site, including identification of pedestrian activity, circulation deficiencies and barriers, and measures to improve such conditions

b. Pedestrian conditions under both the partial and full-build scenarios. Pedestrian pathways, and volumes using them must be shown, with entry and exit points, waiting areas and points of intersection between pedestrian streams. Methods of separating North Station, Boston Garden and office building pedestrian flows must be shown.

c. Pedestrian volume to capacity analysis and levels of services on all sidewalks on the periphery of the site, and along Canal Street and connections to the Proposed Project across Causeway Street, Lomasney Way, and New Nashua Street

d. Flow of pedestrians through the project site during both peak hours and arena events

e. Connections to public transportation station stops

7. Access Plan

a. Measures to manage and reduce parking demand and optimize use of available parking spaces, including:

   o Ride-sharing incentives and information dissemination
   o Set-asides at reduced rates for high occupancy vehicles (specify number and location)

- Parking management to avoid queues and congestion on city streets before and after events

b. Measures to encourage public transportation use and mitigate project impact on public transit including:

   - Mass transit information dissemination
   - MBTA pass sales and subsidies

c. Measures to reduce peaking, including:

   - Travel demand modifications
   - Encouragement of flexible work hours
   - Restrictions on service and goods deliveries

d. Measures to mitigate project impacts, including:

   - Improvements in pedestrian environment
   - Truck access management plan

e. Measures to mitigate construction impacts, including:

   - Scheduling specific construction activities for compatibility with the Central Artery construction schedule, as feasible
   - Time and routes of truck movements and materials deliveries
   - Worker parking and commuting plan
   - Location of construction staging areas
   - Measures to protect the public safety
   - Measures to ensure access along Causeway and New Nashua Streets
   - Storage of materials and equipment

f. A plan must be provided for the reconstruction and realignment of the connection between Nashua Street, Losmasney and Martha Ways. The plan must include the proposed design, a timetable and schedule for phasing the reconstruction with the Garden and Central Artery work and financing plan outlining responsibilities between the MBTA and New Boston Garden Development.

g. Monitoring Program

   A long term program to monitor the travel patterns to and from the project by tenants and other users of the site and the effectiveness of mitigation measures must be submitted. Information must include travel mode, vehicle occupancy rate, and employee origin/destination surveys.

A Construction Management Plan must be submitted to the Boston Transportation Department. A sample is appended to this Scoping Determination.

C. ENVIRONMENTAL PROTECTION COMPONENT

Alternatives for analysis (see Section III B.1) are specified under each of the environmental topics which follow. The following analysis responds to the request made by Spaulding Rehabilitation Hospital as well as other abuttors.

1. Wind

Wind analyses must be conducted as described below for Alternatives A, C, D and E.

A quantitative (wind tunnel) analysis of the potential pedestrian level wind impacts of the proposed buildings is required. This analysis must determine the potential pedestrian level winds adjacent to and in the vicinity of the project site and shall identify any areas where wind velocities are expected to exceed acceptable levels, including the BRA's guideline of an effective gust velocity of 31 mph not to be exceeded more than 1% of the time.

Particular attention must be given to public and other areas of pedestrian use, including, but not limited to, entrances to the Proposed Project and to adjacent buildings, sidewalks on the project site and adjacent to the project site, existing and future MDC parkland along the Charles River Dam, and other public open spaces.

For the draft PIR, erosion testing will be conducted to assess the overall area-wide pedestrian wind conditions for the alternatives described above. Specific hot-wire locations shall be determined during the Final PIR of the Proposed Project.

For areas where wind speeds are projected to exceed acceptable levels, measures to reduce wind speeds and to mitigate potential adverse impacts must be identified.

- o Data shall be presented for both the future baseline (no-build) and for the future build scenario(s).
- o The analysis must include the mean velocity exceeded 1% of the time and the effective gust velocity exceeded 1% of the time. The effective gust velocity must be computed as the hourly average velocity plus 1.5 x root mean square variation about the average. An alternative velocity analysis (e.g., equivalent average) may be presented with the approval of the BRA.
- o Wind direction must include the sixteen compass points. Data shall include the percent or probability of occurrence from each direction on seasonal and annual bases.
- o Results of the wind tunnel testing must be presented in miles per hour (mph).

- Velocities must be measured at a scale equivalent to an average height of 4.5-5 feet.

- The model scale must be such that it matches the simulated earth's boundary and shall include all buildings within at least 1,600 feet of the project site. All buildings taller than 25 stories and within 2,400 feet of the project site should be placed at the appropriate location upstream of the project site during the test. The model must include all buildings recently completed, under construction, and planned within 1,500-2,000 feet of the project site. Prior to testing, the model must be reviewed by the Authority. Photographs of the area model must be included in the written report.

- Sampling time should be for about (166000/(m x Vgr)) sec, where m is the scale ratio (300-600) and Vgr the gradient velocity in the wind tunnel in mph. The measuring device used to measure the ground winds should have a flat frequency response from dc. to a cut-off frequency of ([m x Vgr]/720) hz.

- The written report must compare mean and effective gust velocities on annual and seasonal bases, for no-build and build conditions, and must provide a descriptive analysis of the wind environment and impacts for each sensor point, including such items as the source of the winds, direction, seasonal variations, etc, as applicable. The report must also include an analysis of the suitability of the locations for various activities (e.g., walking, eating, sitting, etc.) as appropriate, in accordance with recognized criteria.

- The report also must include a description of the testing methodology and model, and a description of the procedure used to calculate the wind velocities (including data reduction and wind climate data). Detailed technical information and data may be included in a technical appendix but should be summarized in the main report.

- The report must include maps indicating sensor locations and wind speed data, graphically indicating changes in wind speeds due to the project.

For areas where wind speeds are projected to exceed acceptable levels, measures to reduce wind speeds and to mitigate potential adverse impact must be identified and tested in the wind tunnel.

2. Shadow

Shadow Analyses must be conducted for Alternatives A, D and E, as well as for both Options 1 and 2.

A shadow analysis is required for existing and build conditions for the hours of 9:00 a.m., 12:00 noon, and 3:00 p.m. for the vernal equinox, summer solstice, autumnal equinox, and winter solstice. It should be noted that due to time differences (daylight savings vs. standard), the autumnal equinox shadows would not be the same as the vernal equinox shadows and therefore separate shadow studies are required for the vernal and autumnal equinoxes.

The shadow impact analysis must include net new shadow as well as existing shadow and must clearly show the incremental impact of the proposed buildings. Shadows of surrounding buildings also shall be included, as appropriate, to indicate clearly the net shadow impact of the Proposed Project.

Particular attention must be given to existing or proposed public open spaces and major pedestrian areas, including, but not limited to, the sidewalks surrounding the project site, the Proposed Project's open spaces and pedestrianways, existing and future MDC parkland along the Charles River and the Charles River Dam, and other public open spaces.

Design or other mitigation measures to limit or minimize any adverse shadow impact must be identified.

3. Daylight - Alternatives A and E

A daylight analysis for no-build conditions and Alternative E must be provided by measuring the percentage of skydome that is obstructed by the Proposed Project. The analysis must be based on the BRADA program. Viewpoints must be taken from each public way bordering or within the project site, centered opposite each major building component in the proposed project. For the analysis of Causeway Street impacts, comparisons should be made to the existing conditions on both sides of the street. The elevated Green Line tracks must not be included in either no-build (existing) or proposed buildout conditions.

4. View Studies - Options 1 and 2

View Analyses must be conducted for Options A and B where alternate massing of the building will be visible from important public or private areas. View study must be conducted of existing project and proposed development from each of the major roadways in the area, from each of the public parks or open spaces within the vicinity and from the abutting parcels whose views may be altered due to the construction of the tower elements. The view locations should be approved by the BRA before analysis is begun. View studies should be cognizant of light and shadow, massing and bulk. Written and/or graphic description of the building materials and its texture, color, and general fenestration patterns of the proposed development.

5. Air Quality

Air quality analyses must be conducted for Alternatives A, B, C, D and E.

DPIR must describe the existing air quality in the vicinity of the Proposed Project, and must evaluate ambient air quality levels to determine conformance with the National Ambient Air Quality Standards of the U.S. Environmental Protection Agency.

A future air quality (carbon monoxide) analysis is required for any intersection where level of service is expected to deteriorate to D and the Proposed Project causes a ten percent increase in traffic, or where the level of service is E or F and the Proposed Project contributes to a reduction of level of service. The methodology and parameters of the traffic-related air quality analysis must be approved in advance by the Massachusetts Department of Environmental Quality Engineering ("DEQE") and the BRA. Mitigation measures to eliminate or avoid any violation of air quality standards must be described. Traffic on the abutting Central Artery roadway and ramps must be included in the air quality analysis, as well as background traffic.

In addition, a description of the garage exhaust system, including location of exhaust vents and specifications and an analysis of the impact on pedestrian level air quality from operation of the exhaust system must be required. Measures to avoid any violation of air quality standards must be described.

The DPIR also must describe ventilation requirements and exhaust system for the covered train tracks, and must evaluate the air quality impacts resulting from the diesel exhausts from the train station. Particular attention must be given to NO2 and TSP emissions and to diesel fumes. The air quality analysis must model the dispersion of these pollutants and the diesel fumes and must describe their impacts on pedestrians and on adjacent buildings and their ventilation systems. The analysis must compare the estimated emissions with the DEQE policy guidelines for NO2 concentrations and must describe appropriate mitigation measures to avoid any violation to avoid any violation of these guidelines. The methodology and parameters of this analysis must be reviewed with and approved by DEQE and the BRA in advance.

6. Water Quality

The DPIR must describe the existing and future storm drainage system, the location of storm drainage outlets, and the resulting water quality at the outlets. The analysis should address Alternatives A, D and E.

Mitigation measures to prevent the release of pollutants into the receiving waters must be described. (See Section III.A, D and E.)

7. Geotechnical Impact

The results of the MBTA analysis of existing sub-soil conditions will be reported. The DPIR must study the potential effects of the New Boston Garden Development on ground movement and settlement during construction and potential impact on adjacent buildings and utility lines, and on the adjacent MBTA transit tunnels. This analysis must include a description of the foundation construction methodology, pile-driving proposals, the amount and method of excavation and the disposal of the excavate, and measures to prevent damage to adjacent buildings, utility lines, and MBTA facilities.

Since the excavation will extend below the groundwater level, an analysis is required of the impact of New Boston Garden Development foundation construction on the maintenance of groundwater levels and on foundation supports of adjacent structures and infrastructures. Measures to ensure that groundwater levels will not be lowered during or after construction must be described. (Use Alternative E of III.B.1.)

8. Solid and Hazardous Wastes

The amount and method of demolition of the existing buildings and infrastructure on the project area controlled by the proponent must be described and the disposal site for the demolition of debris must be identified. The removal and disposal of any asbestos material from buildings to be demolished must also be described.

The generation of solid wastes from the Proposed Project and plans for removal and disposal must be described.

The DPIR must describe whether any oil contamination or potentially hazardous materials exist on the area controlled by the proponent that is controlled by the New Boston Garden Development Corporation and must describe their disposal. If Chapter 21E site evaluation has been prepared for the site, it must be included in the DPIR. (Use Alternative E of III.B.1.)

9. Noise

An evaluation of the ambient noise levels outdoors must be conducted in conformance with city, state and federal standards. Should excessive ambient noise levels exist, mitigation measures to reduce these levels during or after construction must be described. This analysis should address Alternatives A, D and E.

Anticipated long-term noise increases from project-generated traffic and from the project's building mechanical equipment shall be evaluated, and the potential impacts on sensitive receptors, including pedestrians and nearby residences, hospitals, and recreation areas, shall be described.

10. Construction Impacts

Construction impact analyses must be conducted for Alternatives C and E.

A construction impact analysis is required which includes a description and evaluation of the following:

a. Potential dust and pollutant emissions and mitigation measures to control these emissions

b. Potential noise impact and mitigation measures to minimize increase in noise levels

c. Location of construction staging areas and construction worker parking

d. Construction schedule, including hours of construction activity

e. Access routes for construction trucks and anticipated volume of construction truck traffic

f. Measures to protect the public safety

g. Coordination of project construction with the construction of several other major projects within the immediate vicinity during the same period, including the Central Artery reconstruction, the MBTA North Station project (underground garage and commuter rail platform work, the Green Line rapid transit relocation, and the realignment of Nashua Street). Additional impacts (air quality and noise levels, construction traffic, access, and parking, and staging areas) of the projects must be described, as they either increase or decrease the impacts of the aforementioned projects.

h. Coordination with Central Artery reconstruction

11. Rodent Control

An analysis of the impact of project construction on rodent populations and a description of the proposed rodent control program and compliance with applicable City and State regulatory requirements is required.

D. URBAN DESIGN COMPONENT

Pursuant to Section 31-5, Paragraph 2, and Section 31-8 of the Code, the following urban design objectives should be addressed in the analysis of both options 1 and 2 required in the DPIR.

1. The Proposed Project's design should create a cluster of towers which can act as a gateway image for the City of Boston. The tower cluster

and massing can be of a scale similar to the tower cluster in the Midtown Cultural District. Due to the larger scale elements adjacent to North Station, the floorplates of the towers may be larger than those in the Midtown Cultural District.

2. The project design should ensure that the new development does not overwhelm the adjacent Bulfinch Triangle historic district. The scale and character of the project should be compatible with downtown Boston. Average setbacks of forty (40) feet at a height of 125 feet and required pedestrian arcades on three sides of the project will mitigate the environmental impacts and reinforce the visual patterns of streets and alleys found throughout Boston's downtown.

3. The Proposed Project should improve the pedestrian environment. Pedestrian arcades and alleys should serve to extend the Bulfinch Triangle toward the Charles River and mitigate against a "superblock" image and form. The public use of both the arena and the train station requires that the public environment and pedestrian movement be paramount design issues. Attention to these aspects of the project will require sidewalks sufficiently wide to accommodate large numbers of pedestrians, generous building setbacks to protect against down drafts of wind, and massing which ensures that sufficient light and air reaches street-level.

4. Both design options should separate pedestrian from vehicular traffic at all access and egress points. Due to the large number of persons moving in and out of the area at rush-hour and after garden events, it is critical to minimize the opportunities for conflict between vehicular and pedestrian traffic, thereby ensuring the smoothest flow of pedestrians through the site and the highest degree of pedestrian safety attainable.

5. As a major, civic project, the New Boston Garden Development must feature the highest quality design standards in the public areas, including the train room and platform area, as well as areas connecting to MBTA facilities. The arena portion of the project should also express a high quality of design throughout. Due to the arena's location and its visibility from the expressway, special attention should be paid to the design of its facade and roof, especially those areas which will be exposed during the phasing/reconstruction period.

Due to the complexity of the Proposed Project and the proposed construction of the Central Artery as well as the diverse character of the adjacent urban design context, a rigorous urban design analysis of the project must be conducted. The purpose of this analysis is to identify any important elements on or adjacent to the site that shape the siting and massing of the New Boston Garden Development and other potential future development integrated in the area. At a minimum the following elements must be studied: issues of access, orientation, massing, site planning, and urban design must be submitted. The area to be included in this study is bounded by North Washington Street to the east, a line approximately 500 feet beyond and parallel to Causeway Street to the south, New Nashua Street to the west, and the Central Artery to the north.

In addition, the applicant must show the degree to which both design options conform to existing urban design requirements as set forth in Article 39 of the Zoning Code.

In order to determine that the Proposed Project (a) is architecturally compatible with surrounding structures; (b) exhibits an architectural form and massing and details that enhances the urban design features of the district in which it is located; (c) augments the quality of the pedestrian environment; and (d) is consistent with the design guidelines for the area, the following information must be submitted for both development options.

Urban design materials for the DPIR must be submitted for Options 1 and 2 up through number 9. The Final PIR Option will include numbers 10 and 11.

1. Written description of program elements and space allocation for each element

2. Plan for the surrounding area and district and sections at an appropriate scale (1" = 100' or larger) showing relationships of the proposed project to the surrounding area and district:

   a. massing
   b. building height
   c. scaling elements
   d. open space
   e. major topographical features
   f. pedestrian and vehicular circulation
   g. land use

3. Black and white 8"x10" photographs of the site and neighborhood

4. Sketches and diagrams to help clarify design issues and massing options for both Option 1 and Option 2. A detailed written sensitivity analysis of these design issues and massing options should accompany the sketches.

5. Eye-level perspective (reproducible line drawings) showing the proposal in the context of the surrounding area

6. Aerial views of the project (existing and proposed)

7. Site sections at 1" = 20' or larger showing relationships to adjacent buildings and spaces

8. Site plan at an appropriate scale (1" = 20' or larger) showing:

   a. General relationships of proposed and existing adjacent buildings and open space

   b. Open spaces defined by buildings on adjacent parcels and across streets

   c. General location of pedestrian ways, driveways, parking, service areas, streets, and major landscape features

   d. Pedestrian, handicapped, vehicular and service access and flow through the parcel and to adjacent areas

   e. Survey information, such as extending elevations, benchmarks, and utilities

   f. Phasing drawings (plans, perspectives, elevations and sections) of the Arena facility as well as the phasing of the tower elements

   g. Construction limits

9. Massing model at 1" = 40' and a study model at 1" = 16' or 1" = 20' showing the facade design

10. Drawings at an appropriate scales (e.g., 1" =8', 1"-16', or 1"-20') to describe the architectural massing, facade design and proposed materials including:

   a. Building and site improvement plans

   b. Elevations in the context of the surrounding area

   c. Sections showing organization of functions and spaces

   d. Preliminary building plans showing ground floor and typical upper floors

   e. Phasing of each building in the proposed project assume a 1995/96 yr. for an Interim Phase

   f. Before and after the Central Artery is reconstructed

   g. Before and after the demolition and reconstruction of Arena.

11. Proposed schedule for submittal of all designs or development related materials

Appendix 3 includes a list of materials required for the Design Development and Contract Documents submissions.

E. HISTORIC RESOURCES COMPONENT

The North Station/Boston Garden Complex was found to be ineligible for listing on the National Register of Historic Places by the Massachusetts

Historical Commission (North Station Urban Renewal Project Final EIR, 11/30/83). Therefore it is not listed in the State Register of Historic Places.

However, the Boston Landmarks Commission staff considers that the structure merits documentation, and requests the following before it is demolished:

Photographic Documentation:

- Present day Views, HABS level (Black & White, large format, not less than 4x5);
- Photographic copies of historic views;
- Photographic copies of original drawings;

Historic Documentation:

The structure merits a report summarizing the significance of its social, cultural, political and entertainment history;

Architectural/Engineering Documentation:

A summary report on the existing Boston Garden and any design or historic facts that connect this building or its design to other buildings such as the Maple Leaf Gardens in Toronto, the Montreal Forum and Chicago Stadium.

The developer is required to submit copies of this information to be deposited at the Boston Landmarks Commission, the Massachusetts State Archives and the Boston Sports Museum.

F. INFRASTRUCTURE SYSTEMS COMPONENT

An infrastructure impact analysis must be performed for Option 1.

1. Utility Systems and Water Quality

a. Estimated water consumption and sewage generation from the Proposed Project

b. Description of the capacity and adequacy of water and sewer systems and an evaluation of the impacts of the Proposed Project on those systems

c. Identification of measures to conserve resources, including any provisions for recycling

d. Description of the Proposed Project's impacts on the water quality of Boston Harbor or other water bodies that could be affected by the project, if applicable

e. Description of mitigation measures to reduce or eliminate impacts on water quality

f. Description of impact of on-site storm drainage on water quality

2. Energy Systems

   a. Description of energy requirements of the project and evaluation of project impacts on resources and supply

   b. Description of measures to conserve energy usage and consideration of the feasibility of including solar energy provisions or other on-site energy provisions.

The discussion of Proposed Project impacts on infrastructure systems should be organized system-by-system as suggested above. The applicant's submission must include an evaluation of the Proposed Project's impact on the capacity and adequacy of existing water, sewerage, energy (including gas and steam), and electrical communications (including telephone, fire alarm, computer, cable, etc.) utility systems, and the need reasonably attributable to the proposed project for additional systems facilities.

Any system upgrading or connection requiring a significant public or utility investment, creating a significant disruption in vehicular or pedestrian circulation, or affecting any public or neighborhood park or streetscape improvements, comprises an impact which must be mitigated. The DPIR must describe anticipated impacts in this regard, including specific mitigation measures, and must include nearby proposed project buildout figures in the analysis, as well as utility reconfigurations proposed under the Central Artery project.

The Proposed Project must also address relocation of, and improvements or terminations to, any active utility lines which cross or enter the site. In addition, the projects potential impacts on the planned Green Line reconstruction and direct connections to the Green Line, Orange Line, and Commuter Rail stations and tracks must be included in this analysis. If these interfaces are more fully treated in another section of the DPIR, that discussion should be referenced here.

Additional constraints or information required are described below.

(1) The location of transformer and other vaults required for electrical distribution or ventilation must be chosen to minimize disruption to pedestrian paths and public improvements both when operating normally and when being serviced, and must be described.

(2) Sewer systems and stormwater systems must be separated if possible; utilization of combined systems should be avoided. Thorough analysis and continuing discussions with BWSC are required.

(3) Water supply systems adjacent to the project and servicing the project should be looped so as to minimize public hazard or inconvenience in the event of a main break.

(4) More information is required regarding Boston Edison's ability to supply electrical energy for project needs with or without the referenced new substation planned for the area, and regarding the new substation itself if it will be required to meet future electricity demands in the project area.

Comments Received

1.	Masterman Culbert & Tully Behalf of Mass. General Hospital and Spaulding Rehabilitation	May 18, 1989
2.	Downtown North Association	May 18, 1989
3.	Massachusetts Historical Commission via Sec. John P. DeVillars	May 29, 1989
4.	City of Boston, Environmental Department	May 17, 1989

APPENDICES

APPENDIX 1

REQUIRED FINANCIAL INFORMATION
NEW BOSTON GARDEN DEVELOPMENT

DEVELOPMENT PROFORMA includes all the information normally found in a development proforma, by phase. This includes, but is not limited to:

Land acquisition costs, per land square foot and total, by parcel. Include distinctions between attributed value and actual out-of-pocket costs, if any. Also include any imputed or actual carrying costs.

Attribution of acquisition expense over project components (per FAR square foot residential, hotel, office, retail, arena parking, etc.).

All hard costs on a per-unit and total basis, by phase (disaggregated into base building, tenant improvement work, rehabilitation work, residential finishes, garage cost, site work, furniture, fixtures and equipment, etc.).

All soft costs on a per-unit and total basis, by phase (disaggregated into individual line items such as architectural, engineering, legal, accounting and developer's fees and any other professional fees, insurance, permits, real estate tax during construction, etc.).

All contingencies on a per-unit and total basis, by phase (specify whether contingency is on hard cost, soft cost, or total cost).

All assumptions regarding financing terms on acquisition, pre-development, and construction loans, by phase (including financing fees, interest rates, terms, drawdown assumptions, terms, participations, amortization).

Calculation of housing and jobs linkage obligation in accordance with Articles 26A and B, and anticipated payment method (over term of obligation or on a net present value basis).

Any other project-related expenses not within any of the above categories.

Calculation of total development cost by component, including total and per unit breakdown (e.g. per square foot office, residential, retail, arena, etc., per parking space, etc.).

Sources of debt and equity for total project costs. Appropriate return measures (return on equity, return on total development cost, internal rate of return; specify method of calculation and hurdle rates).

15-YEAR OPERATING PROFORMA includes all the information normally found in an operating proforma, on a yearly basis. This includes, but is not limited to:

Tabulation of gross and net (leasable) square feet for all commercial space, number of hotel rooms, etc.

Schedule of all rents whether base or percentage rents, on a per square foot and total basis (including anticipated garage rates and occupancy), hotel room rates and projected hotel occupancy rates, and revenues.

Anticipated operating expenses and real estate taxes on per square foot and total basis, and clear explanation of division of expenses between owner and tenants of all commercial, hotel, arena, and garage uses).

All other expense and vacancy assumptions set forth to calculate cash available for debt service.

Anticipated leasing patterns (5-yr, 10-yr, etc.), lease-up rates and calculation of operating deficits if any.

Tenant inducements including free rent, tenant improvement allowances, etc.

Calculation of debt service, before tax cash flow, debt coverage ratios.

Appendix 2

SUBMISSION REQUIREMENTS FOR DESIGN DEVELOPMENT AND CONTRACT DOCUMENTS SUBMISSIONS

1. Revised written description of project

2. Revised site sections

3. Revised site plan showing:

   a. Relationship of the proposed building and open space to existing adjacent buildings, open spaces, streets, and buildings and open spaces across streets

   b. Proposed site improvements and amenities including paving, landscaping, lighting and street furniture

   c. Building and site dimensions, including setbacks and other dimensions subject to zoning requirements

   d. Any site improvements or areas proposed to be development by some other party (including identification of responsible party)

   e. Proposed site grading, including typical existing and proposed grades at parcel lines

4. Dimensioned drawings at an appropriate scale (e.g., 1" = 8') developed from approved schematic design drawings which reflect the impact of proposed structural and mechanical systems on the appearance of exterior facades, interior public spaces, and roofscape including:

   a. Building plans

   b. Preliminary structural drawings

   c. Preliminary mechanical drawings

   d. Sections

   e. Elevations showing the project in the context of the surrounding area as required by the Authority to illustrate relationships or character, scale and materials

5. Large-scale (_e.g._, 3/4" = 1'0") typical exterior wall sections, elevations and details sufficient to describe specific architectural components and methods of their assembly

Outline specifications of all materials for site improvements, exterior facades, roofscape, and interior public spaces

Eye-level perspective drawings showing the project in the context of the surrounding area

Samples of all proposed exterior materials

Complete photo documentation (35mm color slides) of above components including major changes from initial submission to project approval

hase III Submission: Contract Documents

Final written description of project

A site plan showing all site development and landscape details for lighting, paving, planting, street furniture, utilities, grading, drainage, access, service, and parking

Complete architectural and engineering drawings and specifications

Full-size assemblies (at the project site) of exterior materials and details of construction

Eye-level perspective drawings or presentation model that accurately represents the project, and a rendered site plan showing all adjacent existing and proposed structures, streets and site improvements

Site and building plan at 1" = 100' for Authority's use in updating its 1" = 100' photogrammetric map sheets

hase IV Submission: Construction Inspection

All contract addenda, proposed change orders, and other modifications and revisions of approved contract documents which affect site improvements, exterior facades, roofscape, and interior public spaces shall be submitted to the Authority prior to taking effect

Shop drawings of architectural components which differ from or were not fully described in contract documents

MAPC
Metropolitan Area Planning Council
60 Temple Place, Boston, Massachusetts, 02111 • 617-451-2770
serving 101 cities and towns in Metropolitan Boston

May 10, 1989

The Honorable John DeVillars, Secretary
Executive Office of Environmental Affairs
MEPA Unit
100 Cambridge Street
Boston, MA 02202

Project Identification

Project Name: New Boston Garden [illegible] Development
EOEA#: 7701
Project Proponent: New Boston Garden
MAPC: ENF-89-99
Location: Boston
Received: 4/24/89

Dear Secretary DeVillars:

In accordance with the provisions of Chapter 30, Section 62, of the Massachusetts General Laws, the Council has reviewed the Environmental Notification Form identified above and offers the following comments:

1. ____ Environmental Notification Form adequate; no Environmental Impact Report should be required

2. ____ Before a determination can be made as to whether or not an Environmental Impact Report should be required, additional information should be provided on ( ) probable environmental impacts, ( ) alternatives to proposed action, and/or ( ) measures proposed to mitigate probable impacts.

3. _X_ An Environmental Impact Report ( ) should be required, (x) is categorically required.

4. _X_ Additional comments are attached.

Sincerely,

David C. Soule

David C. Soule
Executive Director

DCS/JN/mlm
cc: Richard Dimino, MAPC Rep., Boston
Dick Easler, MAPC Rep., Cambridge
Harris S. Band, Vanasse Hangen Brustlin, Inc.
John Noorjanian, MAPC Staff

Fra E. Baxter, *President* Franklin G. Ching, *Vice-President* Marjorie A. Davis, *Secretary* Martha K. Gjesteby, *Treasurer*
Executive Director: David C. Soule

Additional Comments

Given that an environmental impact report is categorically required, MAPC suggests that the following questions and concerns be addressed:

1. How much additional parking will be planned for the arena itself, over and above the 1,100 spaces proposed for the office/hotel development? A sound parking management plan is necessary to ensure that the parking created for the arena not be used by employees for long term parking.

2. Since patrons to Boston Garden events often travel in groups, i.e. by car/van pools and chartered buses, will the site accommodate high occupancy vehicles (HOVs) by means of direct access to the parking garage or by providing preferential parking or a safe and efficient HOV staging area?

3. If we assume that any shortfall in parking provided by the project will result in an increase in transit use and/or ridesharing, it is essential that the proponents and the MBTA develop a plan to actively promote public transportation as an attractive alternative. Efforts by the MBTA with respect to the Blue Line program to the airport provides an exemplary model.

4. A sound mitigation plan should outline ways to maximize public transit options. Consider the following:

    - running special late trains that leave Boston 30 minutes after the conclusion of a Boston Garden event.
    - Orange and Green Line service which includes a special pass for purchasers of tickets to Garden events which would allow free parking at suburban Orange and Green Line transit stations after 5:00pm.
    - provide a discount round-trip transit ride
    - extend MBTA operating hours on event nights
    - free MBTA express bus service from fringe parking locations from the North, South, and West

5. Does the anticipated expansion of both the Garden and office/hotel development at North Station increase the need for a North Station/South Station connector?

6. Parking fees at North Station for Boston Garden functions could be used to provide a subsidy to pay for traffic mitigation programs. In 1986, North Station parking was used during Red Sox Games and the charge for this parking was as high as $10 per game. Additional revenues to mitigate traffic could come from a premium added to the price of a ticket to a Boston Garden event. An increase of $.50 per ticket could raise $9,750 per game for mitigation, a 2% increase in ticket prices on a $23/seat.

Furthermore, it is important that the traffic analysis section of the EIR thoroughly discuss potential impacts to the Cambridge road system as well as in Boston. Although the location of the project is in Boston, traffic impacts to neighboring Cambridge may be significant in which cases mitigatory measures may be in order. Particularly, the traffic analysis should look at the O'Brien Highway, the Charles River Damn, the Kendall Square Area and the Longfellow bridge.

MAPC

Metropolitan Area Planning Council

60 Temple Place, Boston, Massachusetts, 02111 · 617-451-2770

serving 101 cities and towns in Metropolitan Boston

DATE: April 24, 1989

I.D. #: ENF-89-99

TO: Paul Reavis

COMMUNITY: BRA

Enclosed is a description of the project referenced below.

The Council requests that you consider whether this report adequately describes the project's impact upon your community and addresses significant environmental benefits and potential damages.

PROJECT TITLE: New Boston Garden Development

THE COUNCIL HAS ONLY 20 CALENDAR DAYS TO FILE COMMENT WITH E.O.E.A. TO MEET THIS DEADLINE, YOUR COMMENTS MUST BE RECEIVED AT THE MAPC BY May 10, 1989

☐ ADEQUATELY DESCRIBES ENVIRONMENTAL IMPACTS

☒ MERITS FURTHER ENVIRONMENTAL STUDY

☐ NEED MORE INFORMATION

EXPLANATORY COMMENTS:

This project involves a major redevelopment within the North Station Urban Rene District and is categorically included for the preparation of an Environmental Impact Report. In addition, the project is subject to Article 31 of the Boston Zoning Code and will require the preparation of a Project Impact Report for the BRA. The Authority will issue a comprehensive scope for the PIR, which will require a review and analysis of the environmental, transportation, urban desig infrastructure, and historic resource impacts of this proposed development. In addition, the City of Boston Transportation Department will require a Transport Access Plan and a Construction Management Plan.

SIGNATURE:

DATE: 4 May 1989

Frank E. Baxter, *President* Franklin G. Ching, *Vice-President* Marjorie A. Davis, *Secretary* Martha K. Gjesteby, *Treasu*

Executive Director: David C. Soule

City of Boston
The Environment
Department

Boston City Hall/Room 805
Boston, Massachusetts 02201
725-4416 or 725-3850

MAY 18 1989
MEPA

May 17, 1989

Mr. John DeVillars, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Fl.
Boston, MA. 02202

ATTN: MEPA Unit, Mr. Dick Foster, EOEA #7701, Environmental Notification Form for the New Boston Garden.

Dear Secretary DeVillars:

The City of Boston Environment Department has reviewed the Environmental Notification Form for the New Boston Garden Project and would like to submit the following comments:

1. During the development of this project, The City is concerned that public access across the MBTA tracks connecting Revere Park and the new Spaulding Pier be maintained. Provisions for the link to this continuous MDC walkway along the Charles River should be explained in detail in the Draft EIR.

2. The applicant must obtain a permit for the parking garage from the Boston Air Pollution Control Commission. The Commission will be looking to the developer to explore innovative ways to reduce vehicular traffic to the site, such as mass transit, and car/van pooling.

3. Although the Massachusetts Historical Commission did not find the North Station/Boston Garden Complex eligible for listing on the National Register of Historic Places (North Station Urban Renewal Project Final EIR, Nov. 30, 1983), the Boston Landmarks Commission suggested the property for listing on the National Register in the Central Business District Preservation Survey Draft Summary of Findings (1980). In the Building Information Form for North Station and Boston Garden, the Boston Landmarks Commission stated that the structure is significant as a notable early example of the Art Deco style which survives largely intact and continues to serve its original function as a railroad terminal and coliseum. This finding was omitted from the ENF.

I appreciate the opportunity to comment on this ENF and I look forward to reviewing the EIR.

Sincerely,

L M Downey

L. M. Downey, Director
The Environment Department

Air Pollution Control, Boston Art, Back Bay Architectural, Beacon Hill Architectural, Boston Landmarks and the Conservation Commissions

Boston Water and
Sewer Commission

425 Summer Street
Boston, MA 02210-1700
617-330-9400
Fax 617-330-5167

RECEIVED
MAY 18 1989
VANASSE HANGEN

May 17, 1989

Secretary John P. DeVillars
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, Massachusetts 02202

Attention: MEPA Unit

RE: New Boston Garden Development
EOEA #7701

Dear Secretary DeVillars:

The Commission has reviewed the Environmental Notification Form (ENF) submitted for the proposed New Boston Garden Development. We have several concerns regarding the project and therefore, request that the Draft Environmental Impact Report (DEIR) include the items listed below. We would also appreciate receiving a copy of the DEIR once it is completed. The proponent should note the address change as indicated above.

1. Provide estimates for average and peak water demand and sewer flows. Indicate how the estimates were calculated and include separate water demand calculations for ice making and air conditioning make-up water.

2. Provide a description of the water, sewer and drainage systems currently serving the site. Include an assessment of the capacity of the existing systems to handle the anticipated increases in peak and average flows.

3. With respect to water and sewer service, discuss in detail how this project will be coordinated with the proposed Green Line relocation, the MBTA parking garage, and the construction of the Central Artery.

4. Discuss in detail plans to separate sanitary and storm drains as indicated in the Project Notification Form.

The Commission requires that be kept separate from the sanitary flows, drainage from the site should be conveyed through private storm drains and discharged to local surface waters. Plans to install new storm drains and sewers must be reviewed by the Commission prior to construction.

We thank you for this opportunity to comment on this project.

Yours truly

John P. Sullivan, Jr., P.E.
Chief Engineer

JPS/dr
C/A

cc: Eric Schmidt, BRA
Richard Mertens, BRA
Harris Band, Vanasse Hangen Brustlin, Inc.

DANIEL S. GREENBAUM
Commissioner

The Commonwealth of Massachusetts
Department of Environmental Quality Engineering
Metropolitan Boston - Northeast Region
5 A Commonwealth Avenue
Woburn, Massachusetts 01801

MEMORANDUM

TO: MEPA Office

FROM: Vic Karaian, Environmental Engineer V, Division of Solid Waste Management, Woburn

DATE: May 17, 1989

SUBJECT: Comments on ENF for the New Boston Garden Development Project in Boston

The Environmental Notification Form for the above-referenced project has been reviewed with the following comments:

The ENF notes that the project involves the demolition and removal of the existing Boston Garden structure (including the North station terminal concourse). The debris resulting from this demolition is to be removed by a private contractor. According to the new solid waste bill (specifically Section 9 of Chapter 584 of the Acts of 1987), Section 54 of Chapter 40 of the M.G.L. is amended by including the following paragraph:

> "Every city or town shall require, as a condition of issuing a building permit or license for the demolition, renovation, rehabilitation or other alteration of a building or structure, that the debris resulting from such demolition, renovation, rehabilitation or alteration be disposed of in a properly licensed solid waste disposal facility, as defined by Section one hundred and fifty A of Chapter one hundred and eleven. Any such permit or license shall indicate the location of the facility at which the debris is to be disposed. If for any reason, the debris will not be disposed of as indicated, the permittee or license shall notify the issuing authority as to the location where the debris will be disposed. The issuing authority shall amend the permit or license to so indicate".

It is recommended that the Department of Environmental Quality Engineering and the local Board of Health in the community where the approved disposal facility is located be notified as to the specific facility which will accept the debris for disposal.

It should be noted that asbestos is a special waste as defined in the Department's "Regulations for the Disposal of Solid Wastes by Sanitary Landfill". Permission of the assigning authority (i.e. local Board of Health) must be obtained for the disposal of such asbestos material at an approved facility.

Furthermore, contractors should remain in constant communication with the Department during excavation process to determine classification of waste materials excavated and proper disposal methods and locations (whether the materials are hazardous, non-hazardous, solid waste or urban fill).

VK/ae

cc: Joel Hartley, NERO
DEQE, DSWM, One Winter St., Boston, MA 02108, Attn: Ken Belgrave

The Commonwealth of Massachusetts
Metropolitan District Commission
M. Ilyas Bhatti, Commissioner

20 Somerset Street
Boston, MA 02108
617-727-5114

The Metropolitan Network of Services

Parks

Beaches

Community Boating

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Recreational Facilities

Public Concerts

Trailside Museum

Boston Harbor Islands

Metropolitan Police

Flood Control

atershed Management

Pure Water Supply

abbin, Wachusett and Sudbury Reservoirs

Franklin Park and Stone Memorial Zoos

rkway, Boulevard and Bridge System

Charles, Mystic and Neponset Rivers

aver Brook, Blue Hills, Elm Bank, Breakheart, Middlesex Fells, and ny Brook Reservations

2

May 17, 1989

Mr. Steven C. Davis, Assistant Secretary
Executive Office of Environmental Affairs
MEPA Unit
100 Cambridge Street - Room 2000
Boston, MA. 02202

RE: New Boston Garden: EOEA # 7701

Dear Mr. Davis:

The Metropolitan District Commission is pleased to have this opportunity to comment on the above-referenced Environmental Notification Form (ENF). The MDC does have several concerns with issues raised by this ENF, in particular, how this project adjoins and impacts the Central Artery. The MDC requests that an Environmental Impact Report (EIR), which addresses the following issues, be required for this project:

TRAFFIC- The ENF does not adequately address the impact of the underground garage on the design of the Central Artery. It appears that, if the garage is built as planned, the "E Family" of options for the Artery (e.g., tunnel connections from Leverett Circle to City Square and the Southbound Artery) will be precluded. That is, there will be no real alternative to Scheme Z for the Artery. The MDC requests that the EIR be prepared in such a way as to factor in impacts from the Artery since each project is dependent on the other.

PEDESTRIAN ACCESS/OPEN SPACE/RECREATION- The ENF indicates that there will be enhanced public access to open space. This appears to be incorrect, given that the width of the Garden expansion required to meet the comittment to 19,500 seats, following on the expansion of the MDPW Proposed Action to 18 lanes at Causeway Street, severely restricts access in the area of Accolon Way.

It should be noted that the site plan in the ENF shows a very narrow pedestrian access from Causeway Street to the Charles River which is shared by vehicles exiting from the underground garage. There is an equal absence of public pedestrian space on the east side of the Artery at Causeway Street. The proposed public access from Causeway Street to the Charles River requires that a narrow roadway be shared by pedestrians (coming to and from Charlestown) with Police and maintenance vehicles using the Charles River Dam and the Metro Police Staion. More satisfactory alternatives include: demolishing part of the Charles River Building (as was proposed in early Central Artery schemes to provide for the highway), or selecting Scheme L or Scheme M as the preferrred alternative for the Central Artery.

FILLED TIDELANDS- In discussions with the MDPW and the MDC, the New Garden planners have indicated that they require land for truck turnaround and bus parking on land north of the existing Central Artery ramps. The EIR should require a Chapter 91 license for the project so that use of the land is clearly defined.

The MDC also requests that the proponent continue to coordinate with the MDC and the MDPW in order to resolve the above issues.

Thank you for the opportunity to comment.

Sincerely,

M. Ilyas Bhatti,
Commissioner

MIB/KH/DQ

[redacted]

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Wetlands and Waterways Regulation
One Winter Street, Boston, Mass. 02108

iel S. Greenbaum
Commissioner

ary R. Clayton
Director

TO: Steve Davis, Director, MEPA Unit

FROM: Gary Clayton, Director, DWWR Gary Clayton

DATE: May 18, 1989

RE: EOEA # 7701, New Boston Garden Development
Causeway Street, Boston

The DEQE Waterways Regulation Program has reviewed the Environmental Notification Form, noticed in the April 27, 1989 issue of the Environmental Monitor, for the referenced project and offers the following comments.

The project consists of a three phase multi-use development that is categorically included to require an Environmental Impact Report (EIR) be prepared. In the first phase, a sports arena is proposed to be constructed in an air rights building over an extension of the commuter railroad tracks directly north of the existing Boston Garden. In the second phase, the existing Boston Garden is planned to be demolished to make way for a commercial development consisting of: an office building; a hotel/office building; underground parking garage; and a multi-level public concourse. The third and final phase involves the construction of a hotel/office building on Nashua Street west of the new sports arena.

Chapter 91 Jurisdiction - The project site is located on previously authorized filled private tidelands of the Charles River. Pursuant to Ch. 91, s. 18, any change in use or substantial structural alteration of licensed fill shall require the issuance of a new license by the Department. The proposed project is, therefore, within the Ch. 91 regulatory jurisdiction. Presently, however, only those historic tidelands lying between the existing Mean High Water shoreline and the first public roadway are within the core area of Department interest and will require a Ch. 91 license application review. As stated in the Department's July 25, 1988 letter to Don Kidston of the MBTA regarding other projects in the general vicinity, the first public ways for the site in question are Nashua Street from the Leverett Circle extending east and south to and along the existing Central Artery ramps. To expand on this earlier determination, the public ways adjacent to the project site would be further defined as the Central Artery south of the ramps to Causeway Street and then along Causeway Street in an easterly direction.

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Therefore, it is the determination of the Department that the proposed project site as described in the ENF will not require a Ch. 91 Waterways license application. However, if any revisions are made in the future, regarding the proposed structures or site as described in the ENF, the proponent must contact the Department again to determine whether a Chapter 91 license is required. We would recommend the EIR include a figure describing the proposed project site and development with the first public ways landward of the existing Mean High Water shoreline superimposed on top of it.

Although we will not require a Chapter 91 Waterways license application, the following issues should be addressed in the EIR to assess the potential off site impact on the Charles River waterfront.

New Central Artery - In our comments on the Central Artery/Third Harbor Tunnel interagency draft review of the SEIS/SEIR, the Department has requested more information be provided on the design of a tunnel crossing the Charles River, described as Family of Designs "E". This design alternative had been dismissed by the CA/THT team due to potential environmental impacts but, based on the information provided to date, we would prefer a tunnel to the eighteen lane bridge currently proposed because of the significant visual and physical impact of the bridge on the Charles River and adjacent public parklands.

In Figure 8, "Ground Floor Plan", how would the northeasterly corner of the pile foundation for the new arena be affected by the Central Artery tunnel designs of Family E ? Could the foundation pilings be realigned if a tunnel design was determined to be the preferred alternative?

Public Access - An important goal of the Department is to create a continuous greenbelt along the north and south banks of the Charles River linking Esplanade through the MDC Charles River Dam parkland to the city of Boston's Harborpark. To meet this end, a significant center of public activity such as the new Boston Garden should encourage clear pedestrian access from Causeway Street to the Charles River Dam. In Figure 8, the alignment of the new Accolon Way, garage entry/exit, and service loading area provides a discontinuous pedestrian access. The proponent should analyze the feasibility of a continuous public walkway commensurate in scale to the proposed Building C and Arena as well as landscaping to further welcome the public to the riverfront parkland.

GRC/ADL/al

cc: Deb Hall, GOED
Julia O'Brien, MDC
Harris Band, VHB

E.O.T.C. # 89-0168

The Commonwealth of Massachusetts
Executive Office of Transportation & Construction
Office of the Secretary

Michael S. Dukakis
Governor
Frederick P. Salvucci
Secretary
and
M.B.T.A. Chairman

10 Park Plaza, Room 3510
Boston, MA 02116-3969
Telephone 973-7000
TDD (617) 973-7306

MAY 25 1989
MEPA

(X) E.N.F. ( ) DRAFT E.I.R. ( ) FINAL E.I.R. No.: ______

DATE: 04-24-89 DATE RECEIVED: 04-24-89 COMMENTS DUE: [illegible]

TOWN/CITY: BOSTON, MASSACHUSETTS

PROJECT PROPONENT: NEW BOSTON GARDEN CORPORATION
150 CAUSEWAY STREET
BOSTON, MASSACHUSETTS

PROJECT DESCRIPTION: NEW BOSTON GARDEN DEVELOPMENT, SITE GENERALLY BOUNDED BY CAUSEWAY AND NASHUA STREETS, ACCOLON WAY AND THE CENTRAL ARTERY RAMPS, BOSTON, MASSACHUSETTS. The proposed is the creation of a new, privately funded Arena and commercial development in Boston's North Station Urban Renewal District. Phase I of the project is the construction of a multi-purpose sprots arena on a site immediately behind of the existing Boston Garden. Upon completion of Phase I, demolition of the existing Boston Garden will occur in Phase II to allow the creation of new commercial development on the site. The proposed development will include two buildings, one office and one office/hotel, approximately 1,000 underground parking spaces and a multi-story public concourse. There is projected to be four (4) levels of retail and related uses, including train ticketing facilities in the bases of the office building surrounding the concourse. Completion of Phase two of the project is scheduled for 1997. Phase III will create an office and/or hotel building on Nashua Street to the west of the Boston Garden with completion scheduled for 1999. The project site contains approximately 6.5 acres of land with a total G.S.F. of 3,046,500 including the Arena when completed.

M.B.T.A.: CONVEYANCE OF FEE INTERESTS, AIR RIGHTS AND/OR OTHER PROPERTY INTERESTS
M.D.P.W.: " " " " " " " " " " " "

(X) COMMENTS (SEE ATTACHED) ( ) NO COMMENTS

DATE: 5/18/89

FREDERICK P. SALVUCCI

The Commonwealth of Massachusetts
Executive Office of Transportation & Construction
Office of the Secretary

10 Park Plaza, Room 3510
Boston, MA 02116-3969
Telephone 973-7000
TTY (617) 973-7306

Michael S. Dukakis
Governor
Frederick P. Salvucci
Secretary
and
M.B.T.A. Chairman

ECEI
25 1989
MEP

EOTC ENF Comments on The New Boston Garden Development
Boston, MA
EOEA # 7701

The Executive Office of Transportation and Construction has reviewed the ENF for the proposed Boston Garden Development. The project is proposed to consist of 3 million square feet of development and will be constructed in three phases. Phase 1 will consist of a multi-purpose sports arena, phase II will consist of the demolition of the existing Boston Garden and the construction of two buildings, one office and one office/hotel. Phase III will consist of an office and/or hotel.

The MBTA has several projects proposed in this area. Due to the overlap of the Boston Garden develop project with the MBTA rapid transit and commuter line improvements at the site, a number of transit issues will need to be addressed. In preparing the EIR, the proponent should outline all public and private development proposals for the site, anticipated completion dates for each project, and include a discussion on the proposed phasing for and potential impacts to MBTA projects proposed on the site. Any agreements with the MBTA or City of Boston in regard to mitigation, or any other issues, should also be outlined in the DEIR. EOTC will be available to assist MEPA in the scoping for this project.

The New Boston Garden project is located in an area that is currently served by two rapid transit lines and several commuter rail lines. Given the magnitude of the project and special events that will take place upon project completion, the proponent will be expected to fully analyze traffic impacts and propose a comprehensive mitigation plan that will encourage the use of the transit systems to and from the site. Transportation Demand Strategies that will reduce the number of the trips for both the sports arena and office development should be outlined in the report. Measures should include subsidizing MBTA transit and commuter rail passes for building employees, implementing carpool and vanpool services, and communicating the transit and commuter line services to employees and sports arena clientele.

The traffic report should be completed in accordance with the "EIR/EIS Guidelines For Submission Traffic Impact Assessment".

5/18/89

May 24, 1989

Secretary John P. DeVillars
Executive Director of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

ATTN: Richard Foster, MEPA Unit

RE: New Boston Garden Development, Boston, MA EOEA #7701

Dear Secretary Hoyte:

Staff of the Massachusetts Historical Commission has reviewed the Environmental Notification Form for the proposed project listed above.

The proposed New Boston Garden site is adjacent to the Bulfinch Triangle Historic District and the Charles River Basin Historic District, both of which are listed on the National Register of Historic Places. In addition, the North Washington Street Bridge over the Charles River which is in the project's area of potential impact has been determined eligible for inclusion on the National Register by consensus with the Federal Highway Administration.

Although ENF indicates the proposed new construction will strengthen the historic areas, the proposed structures appear to be out of scale with the adjacent nineteenth century commercial district. The Environmental Impact Report should include a thorough discussion of the adjacent historic resources. In addition, design alternatives should be outlined which address minimizing the adverse visual impacts of the new construction on the historic districts.

MHC staff have concerns about the potential effects that the traffic generated by the new development may have on the North Washington Street Bridge. The EIR should include a traffic analysis that outlines what effects the traffic may have on the historic bridge.

These comments are offered to assist in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800), M.G.L. Ch.9, ss. 26-27c, as amended by Ch. 254 of the Acts of 1988 (950 CMR 71.00) and MEPA.

lassachusetts Historical Commission. Valerie A. Talmage. *Executive Director. State Historic Preservation Officer*
80 Boylston Street, Boston, Massachusetts 02116 (617) 727-8470
Office of the Secretary of State. Michael J. Connolly, *Secretary*

If you have any questions, please feel free to contact Maureen Cavanaugh of this office.

Sincerely,

Valerie Talmage

Valerie A. Talmage
Executive Director
State Historic Preservation Officer
Massachusetts Historical Commission

VAT/tb

cc: John Zajak, DEQE
Chris Barnett, MWRA
Jane Chmielinski, MBTA
Judith McDonough, BLC
Antonia Pollock, BPA
Paul McDonough, Goodwin, Proctor & Hoar
Harris Band, Vanasse, Hangen Brustlin, Inc.

BOSTON
REDEVELOPMENT
AUTHORITY

Raymond L. Flynn

Stephen Coyle

One City Hall Square
Boston, MA 02201
617 722-4300

RECEIVED
JUN 5 1989
MEPA

6.1 '89

Secretary John P. DeVillars
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

ATTN: MEPA Unit

RE: EOEA #7701: New Boston Garden Development

Dear Secretary DeVillars:

Pursuant to regulations implementing M.G.L., Chapter 30, Sections 62-62H, the Boston Redevelopment Authority has reviewed the above-referenced Environmental Notification Form and submits the following comments:

The proposed New Boston Garden Development involves the creation of a new, privately-funded Arena and commercial development in the North Station Urban Renewal District of Boston. The existing North Station/Boston Garden complex would be demolished and replaced by a major mixed-use development consisting of a multi-purpose sports arena on air rights immediately behind the existing Boston Garden, two new buildings - one office and one office/hotel - on Causeway Street and an office and/or hotel building on Nashua Street to the west of the new arena, underground parking for approximately 1,100 cars, a multi-story public concourse, and four levels of retail and related uses, including MBTA ticketing facilities, in the bases of the office buildings surrounding the concourse. The project is proposed to be constructed in three phases, with completion anticipated in 1999. Planning and design of this project have undergone extensive review by the City and the Boston Redevelopment Authority.

The New Boston Garden Development is subject to the review requirements of Article 31 of the Boston Zoning Code. Simultaneously with the filing of the Environmental Notification Form, the project developer - the New Boston Garden Corporation - submitted a Project Notification Form (PNF) to the Redevelopment Authority. At the present time, the Authority's staff is reviewing the PNF, pursuant to Article 31 and will prepare a comprehensive scope for a Project Impact Report. This scope will require a review and analysis of the environmental, transportation, urban design, infrastructure, and historic resource impacts of the proposed development. In addition, a Transportation Access Plan and a Construction Management Plan will be required by the City of Boston Transportation Department. When issued, a copy of the scoping determination will be forwarded to your office.

Since this project will be subject to the environmental review requirements of both MEPA and the BRA, Section 31.13 of Article 31 of the Zoning Code provides for a coordinated review and the submission of a single set of documents to satisfy the requirements of MEPA and Article 31. We concur that a joint review would be appropriate for this project and request that a joint scope for both the Draft EIR and the Draft PIR be issued.

Sincerely,

William Whitney
Assistant Director for
Urban Design and Development

WW:RM/lmc

cc: Lawrence C. Moulter
Chairman/President
New Boston Garden Corporation

James R. Lowell, III
Vice President, Development
New Boston Garden Corporation

Stephen H. Kaiser
191 Hamilton Street
Cambridge, Massachusetts 02139

TO : Steven C. Davis
Director, Environmental Review
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Mass. 02202

June 6, 1989

Attention :

FROM : Stephen H. Kaiser

SUBJECT : NORTH Station

(EOEA # ____)

Please put me on the mailing list for any consultation sessions, site visits or EIR reviews for this project.

Thank you,

H. Kaiser
Stephen H. Kaiser, PhD
Traffic & Transportation Engineer

downtown north association
BOSTON, MASSACHUSETTS 02114

May 18, 1989

Mr. Eric Schmidt
Deputy Director for Special Projects
Boston Redevelopment Authority
One City Hall Plaza - 9th Floor
Boston, Massachusetts 02201

RE: New Boston Garden Development PNF Review by the Downtown North Association, Inc.

Dear Mr. Schmidt:

The Downtown North Association, Inc. welcomes this opportunity to review the recently submitted PNF for the New Boston Garden Development and submit to you our comments and concerns in respect to this major development effort in downtown Boston. Through our initial review of this document, which appears to have been well prepared, our Association has a better understanding of the plans for this new development.

The impacts of a project of this magnitude must be seen today as very uncertain. As proposed, the project (in excess of 2 million square feet) is unusually large and will be built over an unusually long time frame. In the context of unprecedented change is the base infrastructure on which it will draw. As such, the impact of this development demands that a more intensive and comprehensive participation process must be employed in order that the neighborhood concerns are heard, understood, and incorporated into the DEIR. Further, the process must dovetail with that associated with the infrastructure programs. To date there has been limited input by our Association; as such, we consider the following comments as an initial step in the above-mentioned participation process.

Reply to:

OFFICERS

President
PETER L. BROWN
ot & Co., Incorporated

Vice Presidents
MNER EDELSTEIN
Charles River Park
RL R. FLANSBURGH
arl R. Flansburgh and
Associates, Inc.

Treasurer
LOUIS CORAPI
wmut Bank of Boston

Secretary
LARRY MOULTER
Boston Garden Corp.

Past President
PAUL A. MOONEY
Boston Garden Corp

DIRECTORS

JOHN E. BENNETT
Investment Properties
MILLER BLEW
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Boston Brahmin
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setts General Hospital
ROSALIND GORIN
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on Realty Corporation
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LEON K. JOHNSON
all Kitchen Company
ROBERT KENNEY
Development Co., Inc
IRVING LISS
Hilton's Tent City
DANIEL LOONEY
Business Service, Inc
KIM LORING
Room of New England
JAMES LOWELL, III
Boston Garden Corp.
JAMES McGINN
Eagle Graphics
ARKIE REYNOLDS
n Garden Sports Cafe
PETER STEFFIAN
an Bradley Associates
HERBERT STEIN
eway Industries Trust
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The Downtown North Association represents a broad constituency in the Downtown North Area of the City of Boston and is in support of sensible growth and sensitive development. Our members are those who will be most heavily impacted by the New Boston Garden Development and, in concept, we are in support of this proposal for future growth and development. Our comments and concerns raised from our review of the PNF document relate to ways in which the development effort and the associated environmental processes can be enhanced, clarified, and strengthened. Our specific comments are as follows:

Process

In respect to the drafting of the Environmental Impact Report for this project, we suggest that the proponent of the new development organize a forum which includes the Downtown North Association. This forum will be a method through which the affected community can both participate in the process and have their needs and ideas incorporated into the solution. Its purpose would be for the Downtown North Association to have the opportunity to be involved in the process which will lead to an appropriately-scaled development.

This process will also allow our Association, and others, to have advanced knowledge of the changes being proposed and to have advanced communication in developing and reviewing any substantive changes which affect our area. We would like to work with the New Boston Garden Development Team, the City of Boston and other appropriate agencies to determine the most appropriate format for this process.

Specific Transportation Issues

Concerning transportation-related issues, the study and the impact area needs to be more clearly defined in order to draft an appropriate EIR. We suggest the following:

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1. In-depth review of streets in addition to those designated in the PNF;

2. The review of external constraints, such as the intersection at Keaney Square; Haymarket Square; the intersection of Lomasney, Causeway and Merrimac Streets; and the Leverett Circle, which have not been incorporated in the PNF document;

3. Consideration of future changes in the study area, specifically those connected with the depression of the Central Artery. Traffic, parking and loading should be looked into using a model of changes which study the effects both with the Central Artery as planned and without the new Central Artery changes;

4. Review of background growth issues which involve new development and improvements within and surrounding the study area including such projects as the Government Center Garage;

5. Coordination with the City of Boston, the MBTA, the Central Artery, and other agencies involved in development in or adjacent to the study area;

6. Study of loading and media vehicle facilities both with and without arena events;

7. An in-depth analysis of the availability of interim parking will be required to accommodate the small businesses that will lose street level and other parking due to construction;

8. Further and more in-depth study of the integration and timing with the MBTA, Central Artery, and other projects in regard to phasing for the proposed action;

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Mr. Eric Schmidt
May 18, 1989
Page 4

9. A more in-depth study is recommended for the review of the impact on the replacement parking being proposed by the MBTA and Artery, which has now been reduced to a much lower number than originally envisioned in the PNF for the New Boston Garden Development;

10. Peak-hour traffic should be looked at assuming an event at the Boston Garden as well as no event. This, of course, includes service and loading as well as parking and pedestrian flows; and

11. The inter-relationship with the parking garages in the area should be studied to coordinate the efforts of all spaces in the area. This more than likely will be a part of the Transportation Plan submitted by the City of Boston.

Economic Review

The Association recommends that the EIR look into the economic benefits and tradeoffs to be encountered both in the short term and the long term relative to the construction of the proposed action. In this regard, multiple scenarios might be investigated in order to determine the various benefits which might accrue should the proposal be somewhat smaller than presently envisioned. We suggest iterations in program reduction to include a 10% and 20% program level study; even more drastic limitations may be needed if adequate local traffic solutions are not found. In addition, the possibility of recycling the solid waste products of the Arena and the commercial development exists, and should be looked into for both economic and conservation reasons.

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May 18, 1989
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Mitigation

Creative measures should be investigated and studied to mitigate the impacts of both the construction and long term effects of the proposal. These might include the provision of public relations efforts to:

1) Encourage the use of public transit to get to and from the area;
2) Prevent public perception that the Downtown North Area will be difficult to get into and out of during construction; and
3) Up date information on construction schedules for the development.

During construction, the possibility exists of making temporary and/or short term improvements in order to maintain and enhance the quality of life in the Downtown North Area. Mitigation measures can be put into place relative to noise, dust, and pollution and might also include temporary access to the site or even temporary/short term relocation for some of the affected businesses. Both in the short and long term, new enterprises which might occur as a result of this project should be encouraged and be considered. Specific consideration also should be given to the effects of an increase in the number and size of events to be held in the new complex. Construction staging, truck routes, and contractor parking can all be studied in the next stage of the process as well, and we would look forward to working with you and the developer in such studies.

Coordination and Agency Interface

It is highly recommended that a high degree of coordination be provided during the construction and operational stages of the proposal, including City, State and local coordination.

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This is critical in order for the development effort to function as well as possible and for the Downtown North Area to function and thrive. This coordination can easily be a part of the forum which we have requested as part of the next stage in the development process. This will allow for proper communication to occur during the planning and implementation stages.

Also, the Downtown North Association would like to continue our relationship with the Boston Garden, including the use of available facilities such as the Board and Blade which is currently used for Association needs and functions. There may be other opportunities which arise with the new facilities which can be discussed in the next phases of the planning process.

In this limited review of the PNF document, we have attempted to make our comments known in order that the New Boston Garden Development and the associated process can be improved. Our concerns, as you have read, are primarily in the areas of transportation, coordination, and communication. We have also raised issues in respect to mitigation measures both during and after construction; as well as environmental, perception, and economic issues.

In short, the Downtown North Association knows that something is going to be happening that will be good for the neighborhood, including the adjoining residential areas, in the long term. Our goal is to have a good neighborhood to work in and live next to both during the development process and afterwards. To this end, we encourage the development and look forward to working with the proponents in bringing a sensible and sensitive proposal to fruition. We support the development and we expect a commitment from the proponent to go forward.

downtown north association

BOSTON, MASSACHUSETTS 02114

We look forward to receiving your response to our comments, as well as the responses to comments made by other groups involved in or affected by the New Boston Garden Development.

Very truly yours,

P L Brown

Peter L. Brown
President

Peter Steffian

Peter Steffian
Director and Chairman
of the Arena Committee

Reply to:

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Masterman, Culbert & Tully

One Lewis Wharf
Boston 02110

May 18, 1989

Mr. Eric Schmidt
Deputy Director for Special Projects
Boston Redevelopment Authority
One City Hall Square, 9th Floor
Boston, Massachusetts 02202

Re: Project Notification Form -
New Boston Garden Development

Dear Mr. Schmidt:

We have been asked to submit comments on the above Project Notification Form on behalf of the Massachusetts General Hospital and the Spaulding Rehabilitation Hospital (the "Hospitals"). The Hospitals own the property abutting the proposed project immediately to the northwest of the project site. While the Hospitals, at this time, neither oppose nor support the proposed project, they have grave concerns about the effect that the proposed project may have on their property and the future development of their property.

The principal concerns include the following:

1. The existing Spaulding Rehabilitation Hospital is a sensitive receptor which could be affected by air and noise contamination caused by the project. Proposed development of the Hospitals' property includes potential hospital use which would be a sensitive receptor and which could be adversely affected by air and noise contamination.

2. The Project Notification Form does not indicate with any specificity the wind impacts on adjacent properties.

3. The Project Notification Form indicates that shadows would be cast to the north of the project areas onto

the Hospitals' property which could affect the potential development and use of the property. The Project Notification Form lacks any specificity on the extent and nature of the shadows.

4. The Project Notification Form indicates a revised traffic flow in the area and an increase in parking spaces. Although the preliminary calculations prepared by the Proponent's transportation consultants indicates that the project is expected to add relatively few peak-hour motor vehicle trips, the proposed traffic pattern indicates a dramatic increase in the traffic on Nashua Street in the immediate area of the Hospitals' property. This dramatic increase in traffic will have a major impact on the ability of the Hospitals to develop their property.

The Spaulding Rehabilitation Hospital is in the process of developing an addition to the existing facility. The Massachusetts General Hospital has proposed development of approximately 2,000,000 square feet of mixed-use space within its Nashua Street property. Any consideration of the new Boston Garden should take into consideration the likely development of the Hospitals' property and the effects of air pollution, noise, wind, shadows, traffic and parking on the proposed use of the Hospitals' property. The scope of the Environmental Review Process under Article 31 should include appropriate remedial action to eliminate or ameliorate any adverse impact on the Hospitals' property.

Sincerely yours,

Neal C. Tully (ls)

Neal C. Tully

NCT:ls

Hand Deliver
cc: Mr. James R. Lowell, III

Tech Environmental, Inc.
Reservoir Place
1601 Trapelo Road
Waltham, MA 02154
(617) 890-2220

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October 13, 1989

Ref 478

Mr. Richard Mertens
Boston Redevelopment Authority
One City Hall Square
Boston, Mass. 02201

Re: New Boston Garden Project

Dear Dick:

Thank you for your time last Tuesday in discussing the BRA Scope for the New Boston Garden Project. This letter just confirms that discussion.

In reference to section C.5 on Air Quality, in the part regarding train exhaust and ventilation, the term "diesel fumes" is interpreted to mean "diesel odors." Given the difficulty in analyzing the subject of odors, you indicated that a qualitative analysis of odor impacts would suffice for the Draft PIR/EIR and if any more detailed analysis was then needed it could be identified as a requirement for the Final PIR/EIR.

We look forward to working with you on this major redevelopment project.

Sincerely,

TECH ENVIRONMENTAL, INC.

Peter H. Guldberg, C.C.M.

PHG/lg/L2

GOODWIN, PROCTER & HOAR
A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS
COUNSELLORS AT LAW

March 12, 1990

BY HAND

Mr. John Simpson
Section Chief
Division of Wetlands and Waterways Regulation
Department of Environmental Protection
One Winter Street
Boston, Massachusetts 02109

Re: New Boston Garden Development

Dear Mr. Simpson:

This letter is submitted on behalf of our client, the New Boston Garden Corporation, to request a clarification of statements in a May 18, 1989 letter filed by your office with the MEPA Unit in connection with the MEPA review of the New Boston Garden Development (EOEA No. 7701). That letter, a copy of which is attached, stated that a Chapter 91 license would be required only for historic tidelands lying between the existing high water mark and the first public roadway, namely Nashua Street and the Central Artery Ramps. The letter also stated that, because of the location of the site of the New Boston Garden Development, the project would not require a Chapter 91 license.

It has now been determined that the project will entail the use of a small parcel of land held by the Massachusetts Department of Public Works (the "DPW parcel") and located north of the Central Artery Ramps. The DPW parcel lies on filled land which was formerly tidelands, and it is currently proposed that DPW would grant an easement for use of the parcel. With this exception, the location of the project remains as was understood by DEP at the time of submission of the aforementioned May 18, 1989 letter. Enclosed is a plan which shows the DPW parcel in relation to the remainder of the site of the New Boston Garden Development. The DPW parcel is a portion of the parcel shown as "Easement Parcel II" on the plan.

We have been informed by our client that, in connection with the project, the DPW parcel will be used for parking of

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vehicles. We have also been informed that the parcel is currently used as a commercial parking lot, and has been used as a commercial parking lot since well before December, 1983, when Chapter 91 was amended to require licenses for changes in use and structural alterations on filled tidelands. We have determined that the DPW parcel was taken by DPW in 1985, had previously been owned by Gerald S. Fineberg and Daniel Frank, as Trustees of One Fifty Associates Trust since January 15, 1985 (deed at Suffolk Registry of Deeds, Book 11354, Page 114), and prior to that time had been owned by Robert C. Linnell and Arthur G. Carlson, Jr., as Trustees of 140 Trust (deed dated December 20, 1974 at Suffolk Registry of Deeds, Book 8761, Page 356). The DPW parcel would be repaved in connection with its use for the project, but no construction of structures is proposed for the parcel.

Based on the fact that the DPW parcel is currently used for vehicular parking, has been so used since well before December, 1983, and will continue to be so used in connection with the project, we conclude that there will be no change in use or structural alteration of this land and that therefore no Chapter 91 license would be required in connection with its use for the project as described above. We would like to obtain your written confirmation that you concur with this conclusion.

Please do not hesitate to call me at 617-570-1344 if you have questions or need further information concerning this matter.

Sincerely,

Donald S. Berry

Donald S. Berry

DSB/pf
Enclosures
cc: Andrea Langhauser, DEP DWWR (w/ enclosures)
Richard Foster, MEPA Unit (w/out enclosures)
James R. Lowell, III, Delaware North (w/out enclosures)
DP-0078/D

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection
One Winter Street
Boston, Massachusetts 02108

niel S. Greenbaum
Commissioner

May 31, 1990

. Donald S. Berry
odwin, Procter & Hoar
change Place
ston, MA 02109-2881

: New Boston Garden Corporation
Charles River, Boston, Suffolk County

ar Mr. Berry:

The Division of Wetlands and Waterways, Waterways Regulation Program s received your request, dated March 12, 1990, for a jurisdictional termination pursuant to G.L. Chapter 91, for the referenced project. on review of the information provided to us, it has been determined that Waterways License is not required pursuant to G.L. Chapter 91 and its gulations 310 CMR 9.00 (although you may be required to obtain other plicable authorizations prior to commencement of the proposed activity). e proposed activity, continuation of vehicular parking under the isting Central Artery ramps, does not change the existing use nor result i a structural alteration pursuant to G.L. c. 91.

It is understood that the design of the referenced project may need t be refined upon final design selection of the Central Artery Charles ver crossing. If any revisions have been made, or are made in the ture, regarding any of the information provided to us, you are required t submit a new request for jurisdictional determination with supporting d cumentation and plans.

Should you have any questions with regard to this jurisdictional termination, please feel free to contact Andrea Langhauser at 2-5695.

Sincerely,

John A. Simpson
Section Chief

S/ADL/al

: Wetlands Section, D.E.P. Region NE
Boston Conservation Commission
Regulatory Branch, U.S. Army Corp of Engineers, N.E. District

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September 25, 1990

Mr. Stephen Coyle
Director
Boston Redevelopment Authority
One City Hall Square
Boston, Massachusetts 02201

Re: New Boston Garden Development--
BRA Scoping Determination

Dear Mr. Coyle:

This letter is submitted to request the clarifications and modifications of the August 18, 1989 Scoping Determination for the New Boston Garden Development which are set forth below and which have been discussed with your staff. A copy of the Scoping Determination is enclosed. The items covered in this letter are numbered to correspond with the Scoping Determination.

PREAMBLE (see page 2)

The description of the proposed project in the first full sentence on page 2 should be revised to refer to the description in the modified Scoping Determination rather than that in the Project Notification Form ("PNF").

I. New Boston Garden Development Proposed Project Description (see page 3)

All references to the hotel in the project description should be deleted, and the description of the project in the chart should be revised as set forth below to reflect certain changes in sizes, heights, and uses. The Arena will have 105 suites rather than 104 boxes. Building A will have 450,000 gross square feet of office space. Building B will have a height of 425 feet, 844,000 gross square feet of office space, and 39,000 gross square feet of retail space. Building C will have a height of 475 feet, 956,000 gross square feet of office space, and 11,000 gross square feet of retail space. The project will include a public concourse with an area of 16,000 gross square feet that will provide a train station and arena

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access, rather than a pedestal on Causeway Street providing ancillary office and retail space. The note concerning shifting of square footage from Building A to Building B should be deleted.

II. The North Station Economic Development Area Plan and Article 39 of the Code (see pages 4-5)

The first paragraph of this section should be revised to reflect the adoption of Article 39. The fourth sentence of the paragraph entitled "Day Care Facilities" should be revised to refer to Section 39.12.1 rather than Section 38.12.1.

III. Development Review Requirements - Article 31 (see page 6)

The description of the project in the first paragraph of this section should be revised to refer to the description in the modified Scoping Determination rather than that in the PNF. In addition, the third, fourth, and fifth sentences in the first paragraph regarding Options 1 and 2 and massing analyses should be deleted, as should be the descriptions of those options. In addition, references in the first paragraph to the 1989 FSEIS for the Central Artery project should be revised to refer to the 1990 DSEIS/R.

A. General Information

2. Financial Information (see page 7)

The second sentence in this section regarding Options 1 and 2 should be deleted.

B. Transportation Component (page 9)

The references in the second paragraph of this section to Options 1 and 2 and the analyses thereof should be deleted.

1. Vehicular Traffic (see pages 9-10)

The reference in the first sentence of this section to Options 1 and 2 should be deleted. In addition, the list on pages 9-10 of the conditions for which vehicular traffic information will be provided should be revised to refer to the analysis conditions listed in the June 5, 1990 memorandum from Robert M. Kaye to Eric Schmidt rather than Alternatives A through E listed in the Scoping Determination. Paragraph b. should be revised to substitute the words "use as a starting point" for the word "incorporate". Paragraph d. should be revised to refer to the conditions outlined previously rather than the scenarios outlined.

3. Loading (see page 11)

This section should be revised to delete paragraph d. regarding analysis of one-way versus two-way access for trucks along Accolon Way.

6. Pedestrian Circulation (see page 12)

Paragraph a. should be revised to delete the reference to Options A and B. Paragraph b. should be revised to refer to partial and full-build conditions rather than scenarios and to substitute the words "plans for accommodating" for the words "methods of separating" in the discussion of pedestrian flows.

7. Access Plan (see page 13)

Paragraph f. should be revised to refer to the analysis conditions listed in the June 5, 1990 memorandum referred to in B.1. above.

C. Environmental Protection Component (see page 14)

The first sentence of this section should be revised to refer to analysis conditions rather than alternatives for analysis.

1. Wind (see page 14)

The first paragraph of this section should be revised to refer to Conditions A, C, and E, as well as a 1993 condition that includes the New Boston Garden, rather than Alternatives A, C, D, and E. In addition, the first paragraph should be revised to state that the elevated Green Line tracks will be included in the analyses of Condition A and the 1993 condition but will not be included in the analyses of Conditions C and E. In addition, the fourth paragraph of this section should be deleted.

2. Shadow (see pages 15-16)

The first paragraph of this section should be revised to refer to Conditions A and E rather than Alternatives A, D, and

E, and to delete the reference to Options 1 and 2. The fourth paragraph of this section should be revised to state that the elevated Green Line tracks must not be included in the analyses of existing and future conditions.

3. Daylight (see page 16)

The title of this section should be revised to refer to Conditions A and E rather than Alternatives A and E. The last sentence of the section should be revised to refer to existing and future conditions rather than no build and proposed build-out conditions.

4. View Studies (see page 16)

The title of this section should be revised to delete the reference to Options 1 and 2. The first sentence of the section regarding Options A and B should be deleted. The second sentence should be revised to refer to view studies of existing conditions rather than the existing project. In addition, the section should be revised to state that the elevated Green Line tracks must not be included in the analyses of existing and future conditions.

5. Air Quality (see page 17)

The first paragraph of this section should be revised to refer to Conditions A, B, C, D, and E rather than Alternatives A, B, C, D, and E. The third paragraph should be revised to reflect the change in name from Department of Environmental Quality Engineering to Department of Environmental Protection. In addition, the fifth paragraph of this section should be deleted.

6. Water Quality (see page 17)

The first paragraph of this section should be revised to refer to Conditions A, D, and E rather than Alternatives A, D, and E. In addition, the second paragraph of this section should be revised to delete the reference to Section III.A, D, and E.

7. Geotechnical Impact (see page 18)

The last sentence of this section should be revised to refer to Condition E rather than Alternative E.

8. Solid and Hazardous Waste (see page 18)

The third paragraph of this section should be revised to clarify that the Draft PIR must include information on the presence of soil contamination or potentially hazardous materials on the area controlled by the proponent and to refer to Condition E rather than Alternative E.

9. Noise (see page 18)

The first paragraph of this section should be revised to refer to Conditions A, D, and E rather than Alternatives A, D, and E.

10. Construction Impacts (see page 19)

The first paragraph of this section should be revised to refer to Conditions C and E rather than Alternatives C and E.

D. Urban Design Component (see pages 19-22)

The following parts of this section should be revised to delete references to Options 1 and 2: the first paragraph, paragraph #4 on page 20, the first, second, and third full paragraphs on page 21, and paragraph #4 on page 21. Paragraph #5 on page 20 should be revised to require high quality design and materials in the public areas rather than the highest quality design standards in such areas. Paragraph #4 on page 21 should be revised to require clarification of design and massing issues and to delete the requirement of a detailed written sensitivity analysis of design issues and massing options. Paragraph #8.f. on page 22 should be revised to delete the word "perspectives". Paragraphs #1 through #9 on pages 21-22 should be revised to clarify that the commercial component of the project will not require the same level of detail as the arena and that information will be provided in accordance with your instructions. The last sentence of this section should be revised to refer to Appendix 2 rather than Appendix 3.

E. Historic Resources Component (see page 23)

The paragraph entitled "Architectural/Engineering Documentation" should be revised to eliminate the reference to facts connecting Boston Garden or its design with other arenas.

F. Infrastructure Systems Component (see pages 23 and 25)

The first paragraph of this section should be revised to delete the reference to Option 1. In addition, the second sentence in the third paragraph on page 25 should be deleted.

We would appreciate your written confirmation that the clarifications and modifications of the Scoping Determination described above are acceptable. If you have any questions regarding these matters, please let me know.

Sincerely,

Paul F. McDonough, Jr.

PFM:DSB/pf
Attachments
XP-3705/d

GOODWIN, PROCTER & HOAR
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COUNSELLORS AT LAW

BY HAND September 26, 1990

Mr. Richard Foster
MEPA Unit
Executive Office of Environmental Affairs
100 Cambridge Street - 20th Floor
Boston, Massachusetts 02202

Re: New Boston Garden Development EOEA No. 7701

Dear Dick:

New Boston Garden Corporation has requested certain clarifications and modifications in the Boston Redevelopment Authority's Scoping Determination for the New Boston Garden Development. A copy of the letter to the BRA requesting these clarifications and modifications is enclosed.

Because the MEPA certificate regarding the scope of the environmental impact report for the Development incorporated the BRA Scoping Determination, this letter is submitted to request written confirmation that the aforementioned clarifications and modifications are acceptable.

Please do not hesitate to call me or Bob Kaye if you have any questions concerning this matter.

Sincerely,

Donald S. Berry

DSB/pf
Attachment
cc: Mr. James R. Lowell, III
Mr. Robert M. Kaye
Paul F. McDonough, Jr., Esquire
XP-3767/d

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BY HAND   September 26, 1990

Mr. John Simpson
Section Chief
Division of Wetlands and Waterways
Department of Environmental Protection
One Winter Street
Boston, Massachusetts 02109

Re: New Boston Garden Development

Dear Mr. Simpson:

This letter is submitted on behalf of our client, the New Boston Garden Corporation, to request a further clarification regarding the May 18, 1989 memorandum (copy enclosed as Exhibit 1) which was filed by your office with the MEPA Unit in response to the environmental notification form ("ENF") for the New Boston Garden Development (EOEA No. 7701).

The May 18, 1989 memorandum stated that DEP is requiring Chapter 91 licenses only for projects on historic tidelands lying between the existing high water mark and the first public roadway. The letter also stated that, because of the location of the site of the New Boston Garden Development, the project would not require a Chapter 91 license. Subsequently, a letter dated March 12, 1990 (copy enclosed as Exhibit 2) was filed with your office to request a clarification as to the need for a Chapter 91 license for use of a parcel of filled tidelands held by the Massachusetts Department of Public Works (the "DPW parcel") and located north of the Central Artery Ramps for parking of vehicles in connection with the New Boston Garden Development. On May 31, 1990, you issued a letter (copy enclosed as Exhibit 3) stating that, upon review of the information provided in the March 12, 1990 letter, a determination had been made that no Chapter 91 license was required.

It has now been determined that the New Boston Garden Development will entail the construction of a separate storm drain that will run from the area behind the New Boston Garden, through land owned by the Massachusetts Bay Transportation Authority ("MBTA"), to the Charles River just upstream of the New Charles River Dam. The drain will discharge through an outfall to be located above the ordinary high water mark of the Charles River, and the construction of the drain will not require any work in the River or placement of fill below the high water mark of the River. We are exploring the possibility of ownership of this storm drain by the MBTA, with the New Boston Garden Corporation retaining responsibility for its maintenance. Plans showing the location of the new storm drain are enclosed as Exhibit 4.

This separate storm drain, which will be equipped with an oil/water separator, is being constructed at the request of the Boston Water and Sewer Commission to divert storm water which is currently being conveyed to two combined sewers -- the Nashua Street Overflow Sewer and the West Side Interceptor. The new storm drain will divert runoff currently drained to the combined sewers from approximately 7.27 acres of roof and pavement areas on the New Boston Garden Development site and adjacent areas, including portions of the MBTA commuter rail facilities and DPW land. This will virtually eliminate the discharge of storm water from the site to combined sewers. Construction of the new drain will significantly reduce the contribution of the site and adjacent land to combined sewers in the area and thus will contribute to improvement of water quality in the Charles River and Boston Harbor.

Since the new drain will run through land located between the Central Artery Ramps and the Charles River, it will lie in an area within which DEP may assert its Chapter 91 jurisdiction, as indicated in the May 18, 1989 memorandum referred to above and in DEP's new Chapter 91 regulations. However, for the reasons set forth below, we do not believe that a Chapter 91 license should be needed for construction of the new storm drain.

First, an existing storm drain that drains a small portion of the New Boston Garden Development site is currently located in the land through which the new storm drain will run, and thus use of the land for the new storm drain constitutes a continuation of an existing use of that land. In addition, the placement of the new storm drain will not affect the future use, or result in permanent alteration, of the surface of the land through which it will run, with the minor exception of the outfall, and the storm drain will not interfere with public access to the Charles River waterfront in the vicinity or with navigation. Accordingly, we believe that the construction of the storm drain should not be considered to constitute a change in use or structural alteration of this land that requires a Chapter 91 license. Moreover, under Sections 9.12(2)(a)13 and 9.31(2)(a) of DEP's new Chapter 91 regulations, the construction of the storm drain would constitute a water-dependent use project and would be presumed to serve a proper public purpose that provides greater benefit than detriment to the rights of the public in tidelands. The storm drain, which will be constructed entirely in dry land, will provide important water quality benefits without accompanying construction-related water quality impacts or other negative effects. Thus, it appears that no purpose would be served by requiring a Chapter 91 license for the storm drain.

We would like to obtain your written determination as to the need for a Chapter 91 license for the construction of the proposed storm drain. Please do not hesitate to call me at 617-570-1344 if you have questions or need further information concerning this matter.

Sincerely,

Donald S. Berry

Donald S. Berry

DSB/pf
Enclosures
cc: Andrea Langhauser, DEP (w/out encls.)
Richard Foster, MEPA Unit (w/out encls.)
James R. Lowell, III, New Boston Garden Corporation (w/out encls.)
XP-3706/d

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

MICHAEL S. DUKAKIS
GOVERNOR

JOHN DEVILLARS
SECRETARY

September 28, 1990

Mr. Donald S. Berry
Goodwin, Procter & Hoar
Exchange Place
Boston, MA 02109-2881

Re: Scope Modifications: New Boston Garden
EOEA# 7701

Dear Mr. Berry,

I have reviewed your letter of September 26, 1990 and the attachments thereto proposing clarifications and modifications to the scope for the above referenced project.

The scope issued for this project, with minor exceptions that are not dealt with in the modifications, adopted the scope issued by the BRA. I have no objection to the changes and, upon acceptance by the BRA, will consider the scope issued under MEPA to be amended by the changes identified in your letter.

Sincerely,

Janet McCabe
Assistant Secretary
Environmental Impact Review

JMc/RNF/rf

100 CAMBRIDGE STREET, BOSTON, MA 02202 (617) 727-9800

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